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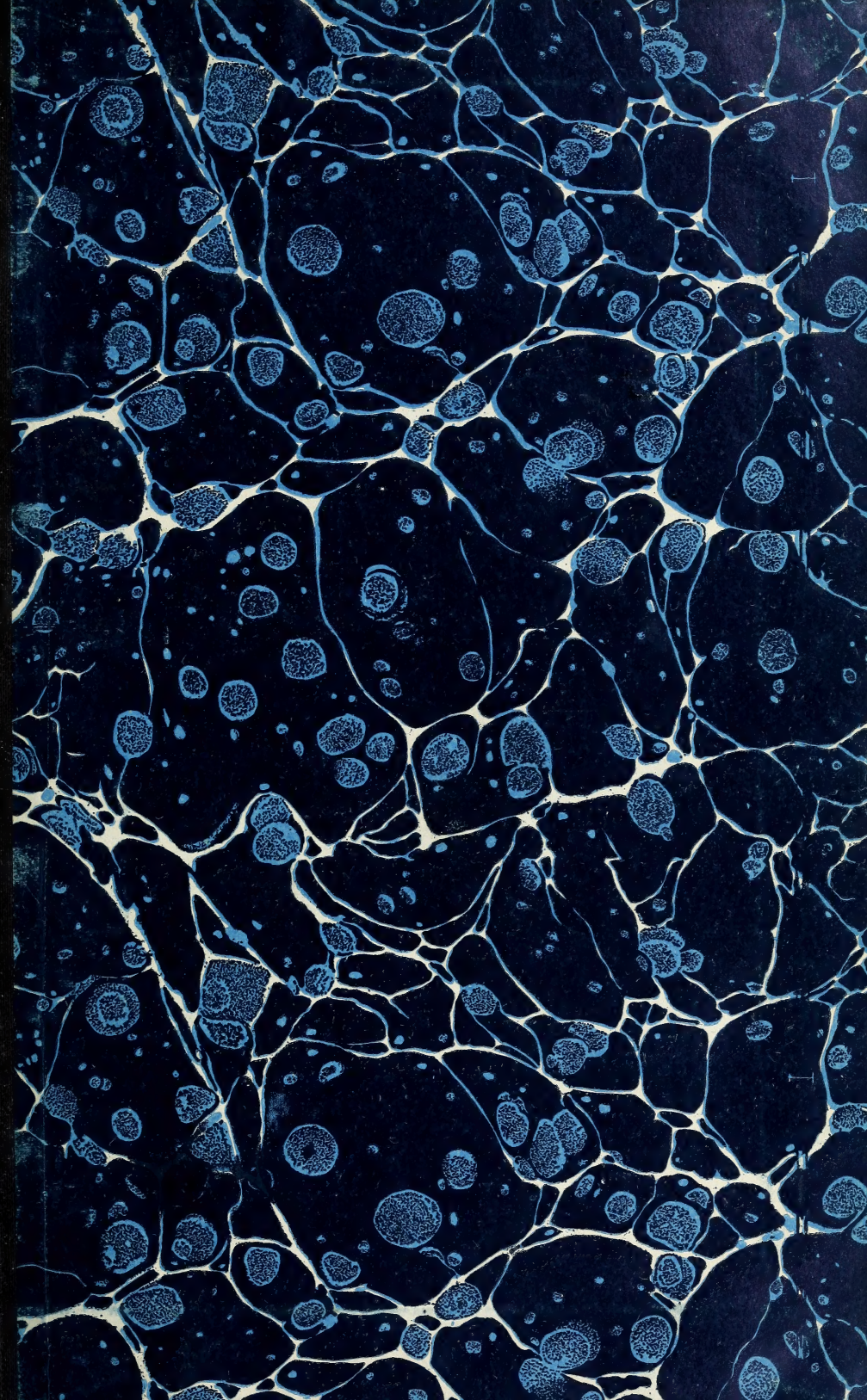

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 851

Office of the Secretary

Contribution from Office of Farm Management
H. C. TAYLOR, Chief

Washington, D. C. July 30, 1920

COST OF PRODUCING APPLES IN FIVE COUNTIES IN WESTERN NEW YORK, 1910–1915

By

G. H. MILLER, Assistant Agriculturist

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INTRODUCTION.

The western New York fruit belt is the oldest commercial apple-growing district in the United States. Few other regions in America have had the benefit of the experience of former generations in the production of apples. Thus, among 218 apple growers upon whose experience this bulletin is based, there are men who have orchards 30 to 60 years of age, as well as those who have recently planted young orchards.

In this region the apple orchard is only a part of the farm business, other fruits and such crops as beans, potatoes, and hay being extensively grown. This bulletin treats of the relation the orchard bears to these other enterprises, of the orchard practices followed by the more successful growers, the effect of these practices on yields, the returns derived from different systems of orchard management, and the cost of maintaining orchards under each system.[1] Detailed

Note.—Acknowledgment is due to the Office of Horticultural and Pomological Investigations of the Bureau of Plant Industry for material assistance in the preparation of this bulletin; also to Messrs. S. M. Thomson and J. C. Folger, who aided in securing the necessary data.

information is presented as to the time required to perform each operation, the necessary equipment, the size of the orchard, the age of the trees, the yield of fruit, and other related factors.

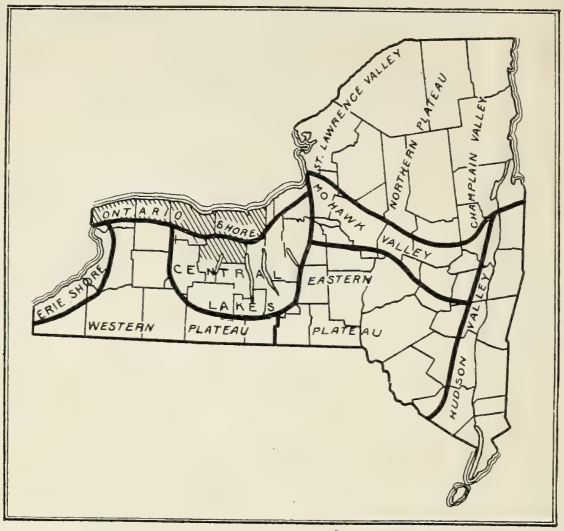

FIG. 1.—Map of New York State, showing the fruit districts. Shaded portion indicates area in which this study was made.

The factors considered in arriving at the annual cost of apple production have been classified as follows:

Labor for maintenance.	Labor in handling.	Materials used.	Fixed charges.
Manuring	Hauling	Barrels	Taxes.
Fertilizing	Picking	Spray materials	Insurance.
Pruning	Sorting	Manure	Equipment charge.
Disposing of brush	Packing	Fertilizers	
Plowing	Hauling to station	Gasoline, oil, etc.	Machine hire.
Other cultivating	Cull labor	Cover-crop seed	Interest.
Thinning			Building charge.
Propping			
Spraying			
Miscellaneous			
Cover-crop labor			

This study was made in the most intensive apple-producing area in western New York, including the counties of Monroe, Niagara, Ontario, Orleans, and Wayne. (See figs. 1, 2, 3, and 4.) These five counties produced 45 per cent of all the apples grown in New York in 1909 (Thirteenth Census).

[1] In the summer of 1914 the Office of Farm Management began a study relative to the cost of production of apples in the five more important apple-producing counties of western New York. The same farmers were visited in the summer of 1916 in order to obtain additional information and note any changes made in the methods of orchard management. Over 200 representative farmers were visited. A method of study similar to that already used in other regions was adopted. Data were secured from each farmer as to the time required for the different operations, as to equipment, cost of labor, spraying materials, barrels, etc., and as to land and orchard values.

SUMMARY OF RESULTS.

Following is a brief summary of the more important averages brought out in this study of 218 bearing apple orchards in western New York.

Acreage:
- Per farm, 118.65.
- Bearing apple orchard, 14.00.
- In other fruit, 20.44.
- In crops, 73.76.

Per cent of farm in bearing apple orchard, 13.38.
Yield per acre, 84.1 barrels (exclusive of culls).

FIG. 2.—View of typical farming country in western New York.

Trees per acre, 35.
Age, 40 years.
Investment:
- Per farm, $25,424.
- Bearing apple orchard, $7,321.
- Per acre, bearing apple orchard, $514.

Per cent apple orchard is of total investment, $29.85.
Total net cost of production per barrel, $1.4124.
- Maintenance, $0.2859.
- Handling, $0.1434.
- Material, $0.5835.
- Fixed, $0.3996.

Per cent of total net cost of production:
- Maintenance, 20.24.
- Handling, 10.15.
- Material, 41.31.
- Fixed, 28.30.

LABOR.

The farms considered in this investigation are of such size that it is usually necessary for an owner or operator to hire one or two men from 8 to 12 months, and ordinarily some extra help during the harvest periods. Data obtained in 1916 show that in 1915 men with families, hired by the year, were usually paid from $300 to $600, depending on the man and the responsibility placed upon him. They are often furnished a house, sufficient garden space for the growing of truck for family use, milk, and fuel, which privileges, as evaluated by the owners, amount to from $75 to $200 annually.

Unmarried men, hired by the month, received from $25 to $45, with meals and lodging, which is valued at 75 cents to $1 per day. When board was not included $30 to $60 was paid. The average period of employment is about 8 months, from April 1 to November 15.

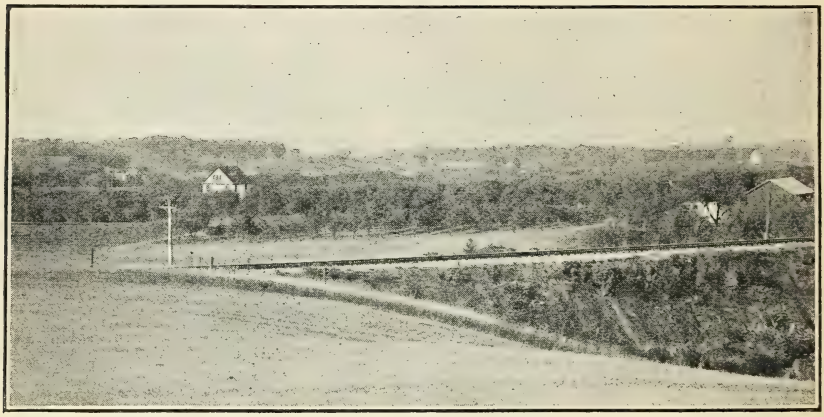

FIG. 3.—View of one of the intensive fruit-growing areas of western New York.

Men hired by the day received $1.50 to $2.50 per 10-hour day. During the last three years it has been increasingly difficult to obtain experienced help, especially at harvest time.

Since all the work, except in some instances the picking and the sorting, is done by the operator and his regular farm hands, the rate of 20 cents per hour has been used for all labor, unless otherwise stated.

All horse labor is figured at 15 cents per hour, which, from previous investigations, is a fair charge.

Figure 5 shows the seasonal distribution of labor and the average time for each operation in the bearing apple orchards of western New York.

FARM INVESTMENT.

The average investment on the 218 farms studied was $25,423.72. The apple-orchard investment, averaging $514 per acre, was 35 per

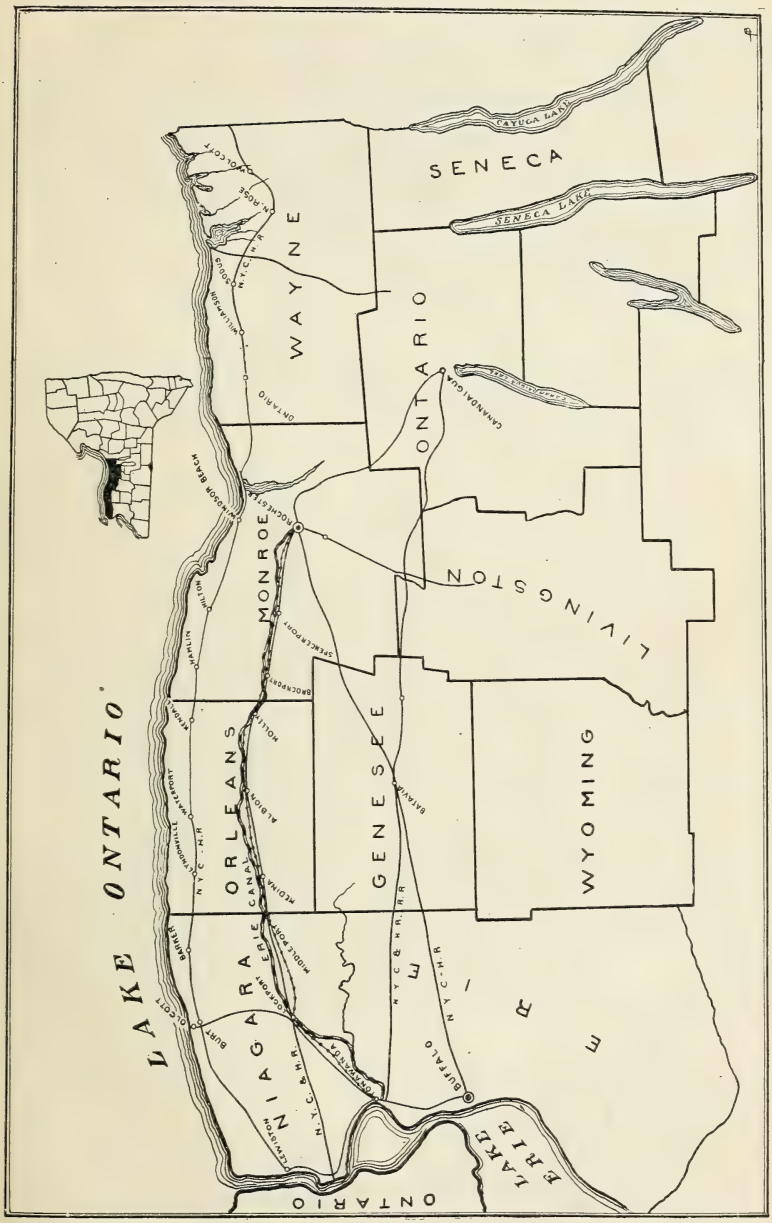

FIG. 4.—Some of the principal shipping points in western New York.

cent of the total land and improvement investment. Table I gives the itemized average investment per farm in the different counties.

TABLE I.—*Average size of farm and of bearing orchard, and average investment per farm and per acre (218 farms, western New York, 1910–1915, inclusive).*

	Wayne.	Ontario.	Monroe.	Orleans.	Niagara.
Number of records	44	42	47	50	35
Average acreage:					
Total	103.34	139.21	116.03	121.10	113.24
In bearing apple orchard	13.88	11.31	13.31	17.04	13.97
Average investment:					
Total	$24,181.08	$21,437.30	$26,838.91	$28,517.43	$25,449.60
Land and improvement	$21,089.77	$17,645.83	$23,616.13	$25,202.75	$22,379.64
In bearing apple orchard	$7,044.55	$4,331.65	$7,359.83	$10,517.84	$6,638.57
Equipment	$1,129.32	$1,326.33	$1,079.13	$1,144.58	$1,121.43
Horses	$945.00	$1,147.00	$1,150.00	$1,186.00	$1,134.00
Other stock	$518.00	$804.00	$541.00	$480.00	$376.00
Average investment per acre:					
Total	$237.48	$163.88	$241.84	$251.30	$232.67
Apple orchard	$499.58	$373.12	$561.11	$629.58	$475.00
Per cent value of apple orchard is of total investment per farm	32.93	21.63	29.34	36.26	27.36
Per cent value of apple orchard is of land and improvement investment per farm	38.65	26.62	33.69	41.25	31.63
Per cent of farm in apple orchard	14.53	10.36	12.97	15.11	13.66
Horses per farm	4.9	6.0	5.5	5.6	5.9

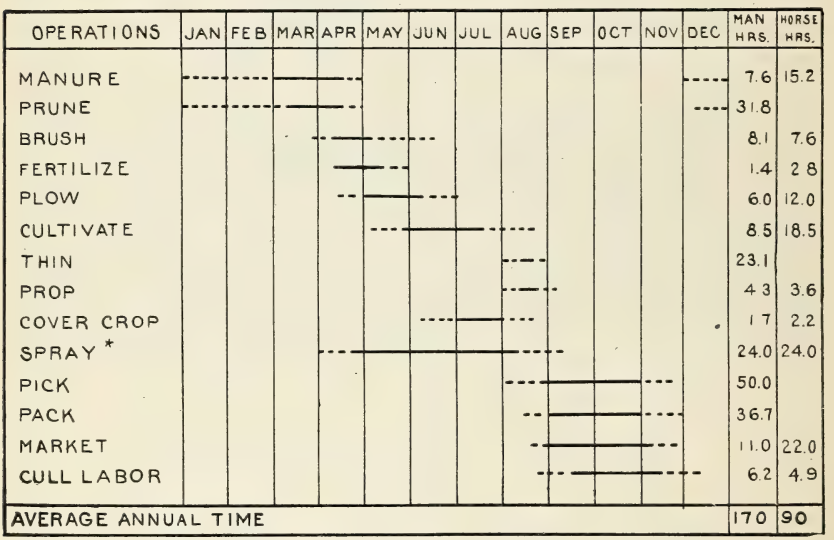

FIG. 5.—Seasonal distribution of operations with average time per acre in bearing apple orchards, western New York. The average time is given for each operation, though the sum of these figures does not necessarily show the labor expended annually, as a grower may not practice each operation every year. There was an average annual expenditure of 170 man hours and 90 horse hours per acre on the farms studied.

The total equipment investment per farm was $1,158.64, of which about $240 represented the spray outfit. The equipment investment outside of the spray outfit was $7.75 per acre.

Table II gives the average total working capital per farm, the number of horses, hogs, cattle, etc., and the average investment per farm in stock and horses. Working capital is considered to include investment in equipment, live stock, and supplies on hand.

* Spraying includes one dormant and three lead arsenate sprays.

TABLE II.—*Average working capital per farm and average investment per farm in horses, stock, and poultry, and number of horses and stock (218 farms, western New York).*

County.	Working capital.	Investment.		Number of head.				
		Horses.	Stock and poultry.	Horses.	Cows.	Cattle.	Sheep.	Hogs.
Wayne	$3,091.31	$945	$518	5	4	2	8	5
Ontario	3,791.46	1,147	804	6	3	4	33	9
Monroe	3,222.78	1,150	541	6	4	3	13	5
Orleans	3,314.68	1,186	480	6	3	1	27	3
Niagara	3,069.96	1,134	376	6	3	2	2	5

TABLE III.—*Principal field crops and acreage and yield of each (218 farms, western New York).*

County.	Records.	Acres per farm.	Tillable area.	Acres in fruit.	Hay.		Corn.		Wheat.		Oats.		Beans.	
					Acres.	Yield.	Acres.	Yield.	Acres.	Yield.	Acres.	Yield.	Acres.	Yield.
			Acres.			*Tons*		*Bu.*		*Bu.*		*Bu.*		*Bu.*
Wayne	44	103.34	91.67	33	16	1½	8	70	5	21	10	45	3	18
Ontario	42	139.21	127.74	22	30	2	10	86	14	28	12	49	5	17
Monroe	47	116.03	105.59	31	17	1⅜	6	85	14	24	10	51	7	17
Orleans	50	121.10	110.57	40	19	1⅜	6	86	11	24	8	50	7	18
Niagara	35	113.24	105.66	48	17	1½	7	80	8	25	10	47	3	20

FARM ORGANIZATION.

The agricultural area of western New York is given over mainly to general farming, with orchard fruit as one of the principal sources of income. The major field crops grown are hay, winter wheat, oats, corn, beans, and potatoes (see Table III). Buckwheat, barley, and rye are minor crops. Limited areas are devoted to truck crops and small fruits.

The classification of farming is often based on the principal source of income, and for that reason many of the farms in the areas studied may be classed as "fruit farms." There is considerable variation in the intensity of this type of farming, depending to a large extent on such factors as proximity to the lake, kind of soil, size of farm, and nearness to market. These conditions govern to a great extent the amount and kind of crops or fruits grown. In Niagara County, for instance, the soil and climatic conditions are such that the growing of peaches has become one of the State's greatest farming enterprises. A large percentage of the farms considered in this county have more acres in peaches than in apples. In Wayne County there are sections that are particularly adapted to raising peaches, truck crops, and small fruits. In Ontario County 83 per cent of the tillable area of the farms studied is in field crops, while 17 per cent is in fruit,

whereas in Niagara County 55 per cent is in field crops and 45 per cent in fruit.

In this area may be found scattering 10- to 25-acre farms, with more or less small fruit or truck crops, but the diversified farms usually are from 80 to 150 acres in size. This gives opportunity to grow one or more cash field crops and feed for the work horses and a limited amount of live stock. By referring to Table IV it will be seen that the average size of farm is about 120 acres. Ninety per cent of the farm area is tillable; 68 per cent of this tillable area is devoted to the growing of crops; 32 per cent is in fruit.

TABLE IV.—*Average size of farms and acreage in crops (218 farms, western New York).*

	Wayne.	Ontario.	Monroe.	Orleans.	Niagara.	Five counties.
Number of farms	44	42	47	50	35	218
Acres in farm	103.34	139.21	116.03	121.10	113.24	118.65
Tillable acres in farm	91.67	127.74	105.59	110.57	105.66	108.20
Acres in bearing apple orchard	13.88	11.31	13.31	17.04	13.97	14.00
Acres in young apples and other fruit	19.60	10.35	17.70	22.99	33.64	20.44
Acres in other crops	58.19	106.08	74.58	70.54	58.05	73.76
Tillable acres per horse	18.54	21.26	18.83	19.77	18.36	19.38

The relative importance of the apple is shown by the fact that 13 per cent of the tillable area of the farms studied is in bearing apple orchards. There are many farms which are almost entirely given to the production of tree fruits, such as apple, peach, pear and cherry. Few of these, however, exceed 500 acres.

NEED OF MANURE.

The western New York farmer feels the need of the application of more manure to his orchards and crop lands and tries to find a way to obtain it most economically. A few men, where the farms are large enough and pasture sufficient, are keeping sheep; some pasture their orchards with sheep a part of the year. Many, to a limited extent, are in the hog business. Again, we find a few men buying cattle in Chicago or Buffalo markets for winter feeding, and selling the same in the spring or when prices seem the best. The need of manure for the orchard is perhaps the principal reason for winter feeding of cattle or sheep in this area. If a profit is made over labor, interest on investment, etc., the farmer feels that the enterprise has more than justified itself.

CROP ROTATION.

There are several practical rotations which are used in this area, depending, of course, on the crops grown. One of the most common is (1) oats, (2) wheat, (3) clover and timothy hay from one to four

years, and (4) corn. The following rotations are also found in common use throughout this area:

(1) Oats, (2) wheat, (3) clover, (4) potatoes.

(1) Oats, (2) wheat, (3) clover, (4) beans, (5) corn.

(1) Wheat or rye, (2) clover, (3) beans, (4) corn or potatoes.

Within the past few years, when weather conditions would permit, many farmers have been following what seems to be probably the most economical rotation to be used in the production of beans, namely, (1) wheat, (2) clover, (3) beans.

THE ORCHARDS.

There is great variation in the type and present condition of the older bearing apple orchards of western New York. On this account, in order to arrive at what was deemed a fair figure for cost of production, it was necessary to select for study orchards of about the same physical condition and age. This necessity eliminated from investigation many of the older orchards which had originally been set so close that every other row or tree in the row had been removed, those in which resets had been planted, and a few mixed orchards in which there were other kinds of fruit trees with the apples. The orchards selected for investigation were only those which were in every way comparable and representative of normal conditions.

Commercial orchards of the western New York district are generally well managed. The growers know the importance of constant care in order to insure fair returns over a period of years. Past experiences have taught them that neglect for a year or two may be disastrous.

SIZE OF ORCHARDS.

Orchards in this area vary from the acre or acre-and-a-half family orchard to the large commercial orchard containing 50 to 100 acres. The average for the different counties, as covered in this survey, is shown in Table III. As the farm increases in size there is a tendency toward increased acreage in fruit. Some farms are devoted almost exclusively to fruit. This condition, however, is the exception, and farms of this type were not considered in this investigation.

TABLE V.—*Classification of records, according to age of bearing apple orchard (218 farms, western New York).*

Groups.	Number of records.	Average age.
Under 20 years	1	18
20 to 30 years	36	28
30 to 40 years	105	37
50 to 50 years	64	47
50 to 60 years	8	56
Over 60 years	4	61

AGE OF TREES.

Orchards visited in this study average 40 years old. Table V shows the number of orchards of different ages. Perhaps 85 to 90 per cent of the orchards in these counties are over 20 years of age, and there are many profitable orchards over 50 years of age. The number of years that a western New York apple orchard will live and produce profitable crops has not been clearly determined. However, there is reason to believe that the average western New York apple orchard reaches its maximum yielding power when it is between 40 and 50 years of age. This, of course, depends to a very great extent on the variety of apples, the type and condition of the soil, and the kind of care which the trees receive.

TREES PER ACRE AND THE METHOD OF SETTING.

The trees in many orchards of this region are set too close, and most orchardists realize this fact. In the early days of planting many of the orchards were set 30 by 30 feet or less. Practically all of the early orchards were set on the square. Within the past few years it has been the plan to plant such standard varieties as Baldwin and Rhode Island Greenings 40 to 50 feet apart and interset these with either peaches or earlier bearing apples such as Wealthy, Gravenstein, Oldenburg, Alexander, and Twenty Ounce. When the peaches have fulfilled their mission or when the interset apples begin to interfere with the standard varieties they are removed. The apple orchards considered in this investigation averaged 35 trees per acre.

VARIETIES.

The Baldwin stands first in output among the apples grown in western New York. This variety constitutes from 50 per cent to 60 per cent of the apples grown. The Rhode Island Greening ranks second.

The apples grown here are classified commercially into summer, fall, and winter varieties. The principal summer and fall varieties are Oldenburg, Wealthy, Gravenstein, Alexander, Twenty Ounce, and Hubbardston, while the principal winter varieties are Baldwin, Rhode Island Greening, Northern Spy, Roxbury, Tompkins King, and Ben Davis. Several other varieties are grown, but these do not materially affect the commercial market.

ORCHARD INVESTMENT.

An estimate of the value of the bearing apple orchard on the farm was obtained from each farmer. The average investment per acre for the orchards here considered was about $500. There was some little variation in the value of land. The apple orchard, how-

ever, made up about one-third of the estimated land and improvement investment.

The average investment per acre for crop land and for apple orchards was the highest in Orleans County and the lowest in Ontario.

YIELDS.

Figures on yields were obtained from each grower covering a period of six years, 1910 to 1915, inclusive. Table VI shows the average yields in barreled and culled fruit and per cent that each class is of the total yield. Considering all counties, 24 per cent of the total yield was culls, and 76 per cent, or 84 barrels per acre, was packed fruit. The packed barrel yield, as reported, is affected by the method of sorting and packing. Some growers sort and pack more closely than others, and often much of the fruit which the grower might put in a barrel would be culled by another.

TABLE VI.—*Showing barreled and cull yields per acre and per cent that each is of the total yield (218 farms, western New York, 1910–1915, inclusive).*

Counties.	Records.	Barreled yield.		Cull yield (barrels).	
		Per acre.	Per cent of total yield.	Per acre.	Per cent of total yield.
Wayne	44	73.2	67	36.6	33
Ontario	42	93.3	79	24.3	21
Monroe	47	85.3	78	24.0	22
Orleans	50	86.8	77	26.6	23
Niagara	35	81.4	79	22.2	21
All counties	218	84.1	76	26.9	24

Most of the apples were packed by the farmers themselves. Usually two or three grades were made. The apples which were not barreled were hauled either to a drier or cider mill.

There were some variations in what the individual growers considered a No. 1 or No. 2 apple. Wayne County growers show the smallest barreled yield, and the largest per cent of culls. The business of drying apples has long been established in this county and not many years ago it was the custom to dry most of the fruit. Many growers still dry much fruit which might, in other counties, appear as barreled fruit. The total yield for this county is somewhat below the average yield for the other lake counties. Ontario County is a little outside of the limits of the most intensive apple-growing belt. A few years ago a considerable amount of fruit from this county was sold in bulk. To-day a much greater percentage is packed in barrels. However, the majority of growers have not been as careful in packing as have the men in the lake counties. This was one reason for the comparatively high yield reported.

TABLE VII.—*Showing relation between size of orchard and farm (218 farms, western New York.)*

Groups by acres in orchard.	Number.	Acres.		Yield per acre.
		Farm.	Orchard.	
				Barrels.
5 and under	27	84.59	4.53	95.7
5 to 10	67	95.15	7.92	91.9
10 to 20	89	118.03	15.27	72.9
Over 20	35	191.49	29.73	72.8

Table VII shows that there is a tendency toward higher yields per acre with the smaller orchards, and that these orchards are on the smaller farms. Men on the small farms tend to specialize in fruit growing and have the greater percentage of their acreages in fruit. In considering yields it must be remembered that although the yields of Baldwins and Rhode Island Greenings govern to a great extent the average yield for this district, there are grown on many farms the following varieties: Wealthy, Gravenstein, Alexander, Ben Davis, Twenty-Ounce, McIntosh, Tompkins King, and Hubbardston. Table VIII shows the yield by years on 218 orchards in western New York. The influence of the Baldwin apple, an alternating bearer, is evident.

TABLE VIII.—*Yields by years on orchards studied in western New York.*

Years.	Number of orchards.	Yield.
		Barrels per acre.
1910	74	81.1
1911	180	82.0
1912	212	96.2
1913	154	72.6
1914	179	104.4
1915	177	64.1

The net cost of production is influenced by the yield. The total net labor cost per acre grows greater as the yield increases (but not in proportion), while the net labor cost per barrel grows less. The net maintenance cost is a lower percentage of the total net labor cost on farms where an average yield is high than on those where the yield is low.

ORCHARD MANAGEMENT.

There is considerable variation in the methods of orchard soil management followed by western New York apple growers. Many factors influence these methods, among some of the more important of which are nearness to lake, type of soil, and to a great extent the

type of farming followed. The greatest factor, however, is the farmer himself. If he is what is termed a "fruit man" he may be expected to do what is necessary to maintain a profitable fruit business, but unlike many of the northwestern fruit areas, the western New York district does not have many farmers who are in a strict sense apple specialists. General farming is practiced, so that the raising of other crops often conflicts with important orchard work. The men here can not give the individual care and thought to the orchard business that the northwesterner can give. Much of the cultural work is done by hired labor. Many of the farms are worked on shares, in which case the orchard is frequently neglected, since it is very difficult to make the tenant understand the importance of careful and systematic treatment of the trees over a period of years, though if prospects indicate a large crop or the possibility of fair prices the tenant as well as the owner may cultivate and spray with care.

MAINTENANCE.

The maintenance of an orchard is the real problem in successful fruit farming. Many farmers have the foundation of a successful and highly profitable enterprise, but fail to put their best thought and energies into development and completion of nature's good work. There are many poorly cared for and unproductive orchards to-day in western New York which, with the proper care and encouragement, would produce profitable crops.

The importance of maintenance is evidenced by the single fact that it requires annually about 75 man hours and 60 horse hours per acre. This amounts to about 44 per cent of the total man labor and 68 per cent of the total horse labor used per acre in the production of the apple in western New York.

METHOD OF CULTIVATION.

Generally speaking, in western New York we have two types of orchards—those which are cultivated and those which remain in sod. Of the 218 orchardists who were considered in this study, 193, or 89 per cent, tilled their orchards each year (see Table IX). Of this number, 175 tilled their entire orchard annually. Cultivation usually begins as early in the spring as the condition of the land permits, continuing until the middle or latter part of the summer. After the last cultivation, 108 of the 175 sowed their entire orchards to some cover crop; 67 did not, but allowed the weeds to grow. A few of these men pastured their orchards late in the season. An estimate of the value of such pasture was given by the growers and a corresponding credit was allowed in arriving at the cost of production. Fourteen men tilled their orchards, but not annually; 11 left them in sod.

TABLE IX.—*Different methods of soil management (218 farms, western New York).*

Items.	Number of records.	Per cent of total records.
All farms	218	100
Till entire orchard annually	175	80
Till and cover-crop entire orchard annually	85	39
Orchards in sod	11	5

The most intensive part of the cultivation is done early in the spring, with the object of forming a dust mulch. Plowing is usually done with a 12- or 14-inch plow, the grower making a practice of plowing toward the tree row one year and away from the row the following year in order to keep the orchard level. A few men used gang plows. Four to six inches is the usual depth of plowing.

Orchard tillage is continued throughout the season as the farmer feels its need or finds time to cultivate. It sometimes happens that on account of rain it is almost impossible to make any cultivation. This, however, is not common. Ordinarily, if the orchard is well worked up in the early spring, it will be necessary to cultivate it once in 10 days or 2 weeks in order to hold the dust mulch. It was found that those who cultivated worked their orchards over an average of seven times a season.

One or more of the following implements were used after the plow: The disk harrow, roller, spring-tooth, spike-tooth, or light-draft harrow. Table X gives the average day's work, with the cost per acre for the above-mentioned implements.

METHODS OF FERTILIZING.

Closely allied with the cultural practice is that of fertilizing. One hundred and sixty-seven orchardists tilled annually and used some kind of fertilizer; 44 used barnyard manure; 60 barnyard manure and a cover crop; 38 barnyard manure, commercial fertilizer, and a cover crop; 19 barnyard manure and commercial fertilizer; and 6 a cover crop. Not all of these men, however, made such use of manure or fertilizer an annual practice.

TABLE X.—*Average time required and cost for different cultural operations in bearing apple orchards with a crew of one man and two horses (western New York).*

Implement.	Acres in 10 hours.	Cost per acre.
Walking plow	1.98	$3.00
Roller	12.07	.45
Disk	7.03	.84
Spring-tooth harrow	9.67	.57
Spike-tooth harrow	11.53	.48

Orchards which were tilled annually (see Table XI) are divided into three groups—those which used (1) barnyard manure; (2)

barnyard manure and a cover crop; (3) barnyard manure, fertilizer, and a cover crop. The majority of annually tilled orchards are in one or another of the above groups. The barrel yields per acre for these groups are 85.8, 85.6, and 86.4, respectively; the maintenance costs per acre $24.34, $26.85, and $28.35, respectively. The chief differences are in the time spent in pruning, cultivating, and spraying. The handling costs were about the same in each group, respectively, $25.85, $26.42, and $28.74 per acre. The material and fixed costs per acre are $76.72, $85.37, and $93.52, respectively. These variations in costs are due chiefly to differences in the estimated valuation of orchard land, the apple-building charge, the cost of spray material, manure, and fertilizer. The total net cost of production per acre was $113.67, $125.64, and $133.47, respectively, making a net cost of $1.33, $1.47, and $1.54 per barrel. With yields approximately the same and the cost of production increased by more intensive management, the net returns per acre were least from the orchards in group 3.

TABLE XI.—*Average maintenance, handling, material, and fixed costs per acre for orchards, grouped according to methods of fertilizing (western New York, 1910–1915).*

Items.	Group 1.—Manure (44 records).	Group 2.—Manure and cover (60 records).	Group 3.—Manure, fertilizer and cover (38 records).
Yield per acre (barrels)	85.8	85.6	86.4
Value apple orchard per acre	$434.00	$532.00	$543.00
Maintenance costs:			
Manuring	2.35	2.31	2.26
Fertilizing	.....	.....	.49
Pruning	4.99	4.54	5.51
Brush	2.20	1.95	2.23
Plowing	2.82	2.73	2.64
Cultivating	4.73	5.32	4.78
Thinning	.49	1.39	1.86
Propping	.67	.69	.74
Miscellaneous	.06	.04	.10
Cover crop	.....	.63	.65
Mowing	.04	.09	.08
Dormant spray	2.03	2.13	1.88
Summer spray	3.96	5.03	5.13
Total maintenance cost per acre	24.34	26.85	28.35
Total maintenance cost per barrel	.28	.31	.33
Handling costs:			
Station hauling	4.48	4.87	4.62
Other hauling	1.23	.61	.62
Picking	12.07	12.10	13.78
Sorting and packing	6.13	7.05	7.46
Cull labor	1.94	1.79	2.26
Total handling cost per acre	25.85	26.42	28.74
Total handling cost per barrel	.30	.31	.33

Items.	Group 1.—Manure (44 records).	Group 2.—Manure and cover (60 records).	Group 3.—Manure, fertilizer and cover (38 records).
Material and fixed costs:			
Interest	$21.67	$26.58	$27.13
Apple building charge	.51	1.66	3.31
Equipment	3.03	3.54	3.02
Taxes	2.00	2.46	2.11
Insurance	.40	.38	.49
Spray material	8.56	9.33	8.32
Gas and oil	.51	.62	.53
Manure	9.84	8.51	10.67
Fertilizer	.....	.....	5.60
Barrels	30.20	30.42	30.18
Seed	.....	1.87	2.16
Total material and fixed cost per acre	76.72	85.37	93.52
Total material and fixed cost per barrel	.89	1.00	1.08
Total cost per acre	126.91	138.64	150.61
Total cost per barrel	1.47	1.62	1.74
Credits:			
Cull credit	13.05	12.52	16.95
Pasture credit	.17	.48	.12
Total credit per acre	13.22	13.00	17.07
Total credit per barrel	.14	.15	.19
Total net cost of production per acre	113.69	125.64	133.54
Total net cost of production per barrel	1.33	1.47	1.55
Returns per acre	188.76	188.32	190.08
Net returns per acre	75.07	62.68	56.54

The amount and frequency of manurial application is governed to a large extent by the type of farming practiced. As already stated, diversified farming is the most common type in this area. Fruit, however, is one of the chief enterprises. On account of the small number of live stock kept and the lack of other sources of supply, but a small amount of manure is available, and it was found that only 17 growers in group 1 were able to apply such fertilizer each year. The remaining men were fairly evenly divided into those who applied manure to the entire orchard every other year or to one-half, one-third, or one-fourth of their orchard each year. In group 2 somewhat similar methods were used, such as cover-cropping each year, with manure applied to the entire orchard every two years, or to one-half, one-third, or one-fourth of the orchard each year. Variations of a similar nature were also found in group 3.

The highest average yield, 104.9 barrels per acre, was for 13 orchards in group 2 that were annually manured, tilled, and sowed to a leguminous cover crop. Their net cost of production was $143.85 per acre, or $1.37 per barrel. Their average net returns were $86.93 per acre, which was the largest from orchards which were annually tilled. Considering all the orchards which were annually tilled, regardless of the method of fertilizing, the maintenance cost ranged from $20 to $32 per acre, depending upon the intensity of cultivation and the time spent in pruning, spraying, fertilizing, and minor operations. The handling costs per acre on these orchards ranged from $21 to $31. The material and fixed costs ranged from $64 to $100 per acre. There was considerable variation in all costs considered under this heading, particularly in interest on the estimated valuation of the apple orchard, taxes, insurance, etc. The total net cost of production for these orchards ranged from $99 to $145 per acre, while the net returns were from $47 to $87 per acre.

The maintenance cost per acre for the 11 orchards in sod was $14.80, or 19 cents per barrel. The average yield on these orchards was 77 barrels per acre. The handling cost per acre was $21.62, or 28 cents per barrel, while the material and fixed costs were $63.90, or 83 cents per barrel. The total net cost of production of these orchards was $82 per acre, or $1.06 per barrel. The net returns were $87.62 per acre. A credit of $5.55 per acre was allowed on these orchards as the estimated value of the use of the orchard as a pasture. In but few instances were the cultivated cover crops pastured, and such credit was small.

All the sod orchards at the time of this investigation were in good physical condition and appeared to be in as healthy a state as those which were cultivated. However, no account was taken of the amount of foliage, root growth, dead wood, condition of fruit during

the growing season, and keeping qualities of the apples, all factors of more or less importance to the commercial grower.

PRACTICE WITH MANURES.

Ninety-three per cent of the growers visited in western New York make a practice of applying farm manure to their orchards. Of these, 60, or 29 per cent, manure their entire orchard each year, and 51, or 25 per cent, manure a portion of their orchard each year, and 45, or 22 per cent, manure their entire orchard every other year.

TABLE XII.—*Influence of farm manure on yields.*

	Tons per year.		
	5 and under.	5 to 9.	Over 9.
Number of records	29	12	5
Tons of manure per acre	3.62	6.92	12.80
Yield (barrels)	82.7	89.4	99.5

Table XII shows the influence of farm manure when used alone, regardless of method of tillage. As noted above, the apple growers of western New York often make a practice of keeping live stock solely because of the need and value of the manure as a fertilizer. Not enough stock is kept on the average farm to produce the manure necessary for crop and orchard land. A few men who are situated near small towns are able to get more or less manure from town stables; others attempt to rely on manure shipped by the carload from the stockyards at Buffalo.

The rate of application per acre varies from $2\frac{1}{2}$ to 25 tons. The larger amounts are applied where orchards are not manured each year. There is also some difference in the amounts applied annually in each county. In Ontario County, where the percentage of the farm in field crops is comparatively high and the amount of stock kept comparatively large, more manure is applied per acre than in the other counties in question. Furthermore, in the lake counties the peach, cherry, plum, and other fruits may need manure, so that there the apple orchard stands to get a smaller percentage of available manure than in Ontario County.

Green cover crops serve as a substitute for manure. Where there is a shortage of manure, some growers make a practice of using a cover for a year or two, plowing it under, working the orchard up well, and in the following year making a heavy application of barnyard manure.

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Sixty-six per cent of the farmers visited use a team and one man for hauling manure to the orchard. Some men place the manure in piles throughout the orchard and spread it at a later time. A more common practice, however, is to spread the manure from the sled or wagon as it is hauled. Manure is spread some distance away from the trunks of the trees, more often between the rows. Forty of the growers used manure spreaders.

The application is made at any time during the year, most of the manure, however, being applied during the fall and winter. A bobsled seems to be a very satisfactory means of hauling.

TABLE XIII.—*Average expenditure per acre in applying manure (crew, one man and two horses, with wagon or with spreader).*

	Number of records.	Acres in 10 hours.	Hours.		Labor cost.	Tons per acre.	Material cost.	Total cost.
			Man.	Horse.				
With wagon:								
Wayne	21	1.79	8.52	17.04	$4.26	8.74	$15.30	$19.56
Ontario	17	2.38	7.08	14.16	3.54	8.76	15.33	18.87
Monroe	20	2.06	7.93	15.86	3.96	9.33	16.33	20.29
Orleans	29	1.31	8.22	16.44	4.11	9.77	17.10	21.21
Niagara	20	1.36	8.70	17.40	4.35	9.90	17.32	21.67
All counties	107	1.72	8.13	16.26	4.06	9.35	16.36	20.42
With spreader; All counties	26	2.46	5.43	10.86	2.72	8.07	14.12	16.84

Table XIII gives the average time and material required and total cost of applying manure with one man and team in the several counties. The average cost per acre for 133 orchards was $3.81 for labor and $15.93 for material (9 tons), or a total acre cost of $19.74. Considering the average yield for these men, the actual cost would be 23 cents per barrel. It appears that the spreader is the more economical means of applying manure. A crew of one man and two horses with a spreader, applying 9 tons per acre, will cover nearly 2 acres in 10 hours.

COVER CROPS.

Cover crops as a source of humus and nitrogen appear to be more appreciated by the western New York fruit growers now than at any time hitherto. Since the limited amount of manure produced on the average farm in these districts is used to a large extent on crop land, the growing of cover crops and turning them under, giving a supply of humus to the soil, making more plant food available, improving the physical condition of the soil, and to some extent conserving plant food, is almost essential to the well-being of the orchards. Such practice is specially desirable on the heavy clay

soils of some sections of the Apple Belt, which, if not given proper care, become stiff, bake, and are very hard to handle.

The most commonly used leguminous cover crops in this area are red clover and vetch, while the nonleguminous crops are rye, buckwheat, oats, barley, wheat, rape, and cow-horn turnips. It is an advantage if the cover crop grown is a legume, since legumes meet both humus and nitrogen requirements.

Clover is the legume most often used. Usually from 15 to 20 pounds of seed per acre is sown. Both medium and mammoth are grown, the latter being the more popular. It has customarily been sown from July 15 to August 1, though of late growers have been sowing cover crops as early as June 15.

Hairy vetch seems to make a very suitable cover crop. When sown alone from a half bushel to a bushel of seed is used per acre. Vetch lives through the winter and for this reason serves to prevent washing and leaching due to excessive precipitation. The high price of seed is often considered an objection in the use of this cover crop.

The most popular nonleguminous cover crops grown in the orchards of this section are buckwheat and rye. Usually from one half to one and a half bushels of the former and three-fourths to two bushels of the latter are sown per acre. Buckwheat is usually sown before September 1. Rye, when used as a cover, is sown late in September or October. However, it can be sown at any time between July 15 and October 15. Rye usually makes a rapid growth, and it is necessary to get on the land with the plow very early in the spring in order to avoid difficulty in turning it under. Rape and turnips are ordinarily used in combination with other crops, generally clover, sometimes buckwheat or oats. Cover crops are used to a considerable extent thus in combination, clover usually constituting one member, together with such crops as cow-horn turnips, rape, barley, vetch, buckwheat, or oats. In combination proportionally less seed of each crop is usually sown.

It is often difficult to get a stand of a cover crop in many of the bearing orchards, owing to shade, so that many growers allow their orchards to grow up to weeds during the latter part of the summer. Many orchardists depend upon chickweed and think it nearly as valuable as any nonleguminous crop that could be used.

Within the last few years growers have been putting in their cover earlier than they used to, in order to insure a good stand before winter, and it seems to be more and more the general opinion that this should be the regular practice. The time to sow a cover crop depends upon the cover to be sown and the character of the season in which it is being used. With sufficient moisture present in the soil,

other things being equal, the seed is sown earlier than in a dry season.

One hundred and thirty-two, or 60 per cent of the growers, sowed cover crops; 85 of this number sowed the entire orchard every year; 11 every other year. The remainder sowed cover in a portion of their orchard each year, or seeded all the orchard once in two to five years, allowing the cover crop to remain down for a short period.

Forty-three of these growers used clover alone and 26 buckwheat. Forty-seven used a combination of cover crops, 36 of this number using clover as one part of the combination.

A man will usually broadcast between 15 to 20 acres in 10 hours. The average of 118 growers for sowing broadcast was 17 acres per day at a labor cost per acre of about 14 cents. After a cover crop is sown it is usually the practice to harrow it in. Where a team and man are used for this purpose the average cost per acre is about 50 cents.

PRUNING.

Pruning is done annually by 77 per cent of the growers considered in this investigation; 60 per cent prune their entire orchards each year.

Pruning is usually done during the winter or early spring months before any tree growth has taken place. Growers who prune each year usually follow an open-head system on the winter varieties such as Baldwin, Rhode Island Greening, and Tompkins King. Ways of pruning differ slightly with each variety, and each tree presents a problem of its own. With most varieties annual pruning means the general thinning-out of the tree, all dead wood and interfering limbs being removed. The Twenty-Ounce and Northern Spy are handled differently on account of the nature of their growth. The Twenty-Ounce is not pruned with the open head because of danger of sun scald of the main limbs, which is often followed by the New York tree canker, which kills the main limbs, and eventually the tree. The Northern Spy is usually allowed to take its own course with little or no pruning.

There are some differences in pruning practice among the several counties. About 70 per cent of the growers in Wayne and Ontario Counties pruned their entire orchards each year, while in Orleans and Niagara Counties less than 50 per cent followed this practice. This difference may be due partly to the fact that the latter growers have other tree fruits (Table IV) that require their attention, such as the peach, pear, and cherry. Many believe that pruning every other year reduces the annual wood growth and is the better method.

TABLE XIV.—*Average time and cost for pruning 218 orchards, western New York, 1910–1915.*

County.	Number of records.	Acres in in orchard.	Trees per acre.	Age.	Trees in 10 hours.	Man hours.	Cost.		
							Per acre.	Per tree.	Per barrel.
Wayne	44	13.88	35	36	14	32.05	$6.41	$0.1831	$0.0876
Ontario	42	11.31	33	36	12	33.81	6.76	.2048	.0725
Monroe	47	13.31	36	41	16	28.22	5.64	.1567	.0661
Orleans	50	17.04	34	44	14	30.41	6.08	.1788	.0700
Niagara	35	13.97	37	39	11	36.18	7.24	.1957	.0889
All counties	218	14.00	35	40	14	31.85	6.37	.1820	.0757

Table XIV shows a summary of average expenditures for pruning, with tree and barrel costs. A man will prune, on an average, 14 trees in 10 hours, making an acre cost of $6.37, a tree cost of $0.182, and a barrel cost of $0.0757. The annual pro rata pruning cost per acre is $4.85, or 20 per cent of the total net maintenance cost, or 4 per cent of the total net cost of production.

TABLE XV.—*Average pruning cost for different commercial apple-growing areas.*

Locality.	Number of orchard.	Age of trees.	Trees per acre.	Trees in 10 hours.	Hours per acre.	Cost.	
						Per acre.	Per tree.
Western New York	218	40	35	14	31.85	$6.37	$0.182
Wenatche Valley, Wash.[1]	87	11	81	19	40.31	10.08	.124
Yakima Valley, Wash.[2]	120	13	74	14	52.55	13.14	.179
Hood River Valley, Oreg.[3]	54	12	72	30	24.36	5.48	.076
Western Colorado[4]	125	17	74	14	53.67	18.78	.254

[1] Dept. Bul. 446. [2] Dept. Bul. 614. [3] Dept. Bul. 518. [4] Dept. Bul. 500.

Table XV gives a comparison of the number of trees pruned per day and the cost per acre in western New York and four other apple-growing areas, Wenatchee Valley and Yakima Valley, Wash., Hood River Valley, Oreg., and western Colorado. It should be borne in mind that in these areas there are different varieties and conditions, and the trees are considerably younger and also are set very much closer together than in New York.

Summer pruning is not practiced by the growers in western New York. Past experience has taught them that it is not practical. Many of the growers make a practice of pruning a portion of their orchards each year; some prune heavily one year and lightly the next. The size of the orchard seemingly has little effect on the time required for pruning.

BRUSH DISPOSAL.

There are several methods of cleaning up brush. Ordinarily where large limbs are removed, the finer brush is cut from them and the larger pieces used for firewood. Practically all other brush is burned in the orchard. Often there are vacancies where one or more trees have been removed at some time, and this allows sufficient space for burning. The growers use either sleds or low truck wagons for hauling brush. Crews of one, two, or three men are used for loading. Many growers use on the sled a large rack, which can be turned over easily to dump the brush on the fire. It is not unusual to find a grower using one or two 12- or 15-foot poles held 3 to 4 feet apart by 2 by 2 strips, and drawn by a team. This device serves as a rake, the brush gradually collecting across the poles. When a load is gathered it is drawn to the fire and dumped.

Often it is impossible to burn the wood early in the spring, in which case it is placed in piles at convenient places until dry. Some men make a practice of placing the trimmed wood in piles close to the trees as they prune, so that it will be easy to collect at the time that the brush is burned. A few men have homemade brush burners.

Ninety-two of the growers, or 42 per cent, use a crew of two men and two horses, and 54, or 25 per cent, use a crew of three men and two horses in disposing of the brush.

Niagara County shows the highest acre charge ($3.34), and Monroe County the lowest ($2.50), making a cost per barrel, respectively, of 4 and 3 cents.

THINNING.

Thinning is not an annual practice with the majority of apple growers in western New York. A few men do a little every year. Generally speaking, thinning is practiced by commercial apple growers only during the season of large crops or of aphid infestation. Since the western New York apple grower is to a great extent a producer of field crops and fruits other than apples, much of his time is necessarily taken up with general farm work, so that, however anxious he might be to produce a fancier apple than he is now giving the public, he is somewhat handicapped in this regard by the demands of other equally important enterprises. There are in each county and community, however, fruit men who devote the greater part of their time and energies to the production of the apple.

Very few of the apples on trees of the age considered in this bulletin can be thinned from the ground or stepladder, and thus thinning here presents a difficulty unknown in the Northwest. The use of an 18- to 25-foot ladder is necessary in most orchards. When it is considered that in a season of large crops the trees yield from

5 to 20 barrels and often more, the amount of labor necessary to do thorough thinning is obvious. The average grower removes a considerable amount of overabundant and aphid apples and depends upon props to hold up the remaining crop and keep the limbs from breaking. In the case of the younger bearing orchards thinning is more common than with the old orchards, the trees being smaller and the labor difficulties not so great.

Thinning does not seem to affect the quantity or regularity of apple production, although where trees bear well the fruit remaining on trees may be thus increased in size and color.

Probably, if other farm work did not interfere, more thinning would be done; however, only 19 per cent of the growers considered in this investigation followed this practice. The actual cost was $4.63 per acre or $0.05 per marketable barrel. The labor required for this work was 23 hours per acre.

PROPPING.

Propping is governed to a great extent by the amount and method of pruning, by the size of the apple crop, and the thoroughness with which thinning is done. Propping is a more common practice than thinning among the growers throughout western New York, being reported by little over 50 per cent of the men considered in this study.

Board props 1 by 2 or 1 by 3 inches and of lengths varying from 8 to 15 feet are very often used. It is not uncommon to see rails formerly used in an old-fashioned worm fence serving as first-class props. The actual cost for this operation was about $1.40 per acre, or 4 cents per tree.

SPRAYING.

Spraying was introduced into New York State about 1890, just after apple scab and insect pests became so prevalent in western New York that it looked as if the apple business were doomed. Bordeaux mixture was the fungicide first used and Paris green the insecticide. About 1900 lime-sulphur began to replace the Bordeaux mixture. Up to this time Bordeaux had caused considerable damage at different times by russeting the fruit. With the introduction of lime-sulphur this, to a great extent, was eliminated, though under certain weather conditions a heavy application of lime-sulphur, either commercial or homemade, is more or less dangerous. Bordeaux mixture, either the Bordeaux paste or similar mixtures containing a different percentage of copper sulphate, and sold under trade names, is still used by a few growers. Lead arsenate, both in paste and powder, is used as an insecticide. Tobacco extract has been used and is gaining favor among the growers because of its success in the control of sucking insects.

Spraying is perhaps the most important of all maintenance labor. Practically all orchardists in the five counties in which this investigation was made do some spraying each year. From three to six applications per season are made by the commercial growers. The importance of this operation is shown by the bare fact that the labor cost is $6.80 per acre and $8.66 for material per acre, making a total of $15.46, or 13 per cent of the total net cost of production. The tree cost for spraying is 44 cents. This, however, does not include a machine charge.

Gasoline-power sprayers are used by practically all growers. This outfit usually consists of a 2½ to 3½ horsepower engine, with a 100- to 300-gallon tank. The machine and tank are usually hauled on low truck wagons. Either a crew of two men and two horses, or of three men and two horses, is used in spraying. Where two men spray, one ordinarily tends the engine and sprays from the ground, while the other man drives and sprays from the top of the machine or tower. Where three men are used, one man drives, and the other two do the spraying; sometimes one of these men is in the tower. Two leads of hose, usually about 50 feet in length, with pipe or bamboo spray poles, are used. The pressure is usually from 125 to 250 pounds. Many outfits carry spray towers, for without a tower it is impossible to make a thorough spraying of the tops of some trees.

Within the last year or two a new type of outfit, with considerably more power than that of the old type, has been put on the market. Many fruit growers believe that this system will revolutionize spraying.

Dusting with a mixture of sulphur and some form of insecticide has been tried in this part of the country experimentally, and to some extent by growers, during the last three or four years.

DORMANT SPRAY.

"Dormant spray" usually refers to spraying prior to any tree growth, during the months of March and April. However, within the last few years there has been a tendency to delay this early spray until the fruit buds begin to show the tips of the first leaves, or even as late as when the leaves are one-fourth to one-half inch in length. This spray is termed "delayed dormant" or "semidormant." At the time of this investigation no particular distinction was drawn between the growers who made a dormant and those who made a delayed dormant spray. The delayed dormant spray is perhaps the one most generally used. The exact time of application, of course, will vary with the season; it is ordinarily applied during the latter part of April or early in May. Two hundred and six orchardists, or 94 per cent of the total number considered in this investigation, applied the dormant spray. Lime-sulphur, 32° Baumé, strength, 1 gallon to 8

or 12 of water, is generally used, though if San Jose scale is not present this spray is often applied 1 to 40. For the control of chewing insects many growers add to this solution from 4 to 6 pounds of lead arsenate to 100 gallons of material. Tobacco extract is often added, about three-fourths of a pint to 100 gallons of solution, to control aphids. An effort is made to cover the entire tree thoroughly with spray material. The delayed dormant spray is applied for the control of scales, blister mite, aphids, bud moth, and cigar casebearer.

PINK SPRAY.

The pink spray, as the name indicates, is applied when the apple blossoms are pink. The time of application of this spray varies to some extent with locality, owing principally to differences in distance from the lake, variety of tree, etc. Thirty per cent of the growers visited in this investigation applied this spray. Within the past few years this spray has been gaining in favor, for it usually comes at the time when the apple-scab infection may take place, and thus it serves as an effective protection against this fungus. Lime-sulphur is used, the strength varying from 1 to 35 to 1 to 50; that is, 1 gallon of 32° Baumé lime-sulphur to 35 or 50 gallons of water. To this solution lead arsenate is added. When a few aphids are beginning to appear, tobacco extract is used in the delayed dormant spray.

CALYX SPRAY.

The calyx spray is considered the most important by all apple growers. It is usually applied when from one-half to three-fourths of the petals have fallen. Two hundred and fourteen of the growers visited, or 98 per cent, applied this spray. Lime-sulphur is used 32° Baumé, strength 1 to 40, together with from 5 to 6 pounds of lead arsenate to 100 gallons of solution. This spray is primarily applied to control the codling moth. However, red bugs, leaf rollers, and green-fruit worms are often doing damage at this time, so that the commercial apple grower may also use tobacco extract with the lime-sulphur and lead arsenate. If apple scab is present, or weather conditions are favorable for an infection, the lime-sulphur acts as preventive or control spray.

FOURTH SPRAY.

The fourth spray is usually applied two or three weeks after the calyx spray. The method is similar and the material is of the same strength as for the calyx spray. The primary object is the control of the first brood of codling-moth larvæ. However, in the lake

region a great number of larvæ appear late in June and early in July. These latter larvæ cause serious losses of fruit, owing to so-called "side worm entrance." The control of this pest is extremely difficult. This spray also acts as a means of control if apple scab is present.

FIFTH AND SIXTH SPRAYS.

A fifth spray, or second codling-moth spray, is often made during the latter part of July or the 1st of August.

The sixth spray, occasionally made on late varieties, usually occurs from the middle to the latter part of August. In both of these sprays lime-sulphur, 32° Baumé, strength 1 to 40, and lead arsenate 5 to 6 pounds to 100 gallons of solution, are used.

TABLE XVI.—*Comparative labor and material costs per acre when homemade and commercial lime-sulphur solutions are used in spraying bearing orchards (western New York).*

	Number of growers making sprays.	Trees per acre.	Acres in 10 hours	Gallons.		Labor.		Cost per acre.		
				Per acre.	Per tree.	Man hours.	Horse hours.	Labor.	Material.	Total.
Homemade solution:										
Dormant spray	57	36	4.41	278.97	7.75	6.68	5.84	$2.21	$2.67	$4.88
Pink spray	22	33	4.59	308.94	9.36	6.57	5.27	2.10	2.23	4.33
Calyx spray	60	35	4.13	290.54	8.30	7.23	6.11	2.36	2.05	4.41
Fourth spray	21	35	4.36	301.34	8.61	6.74	5.72	2.21	1.96	4.17
Fifth spray	19	33	5.23	248.67	7.54	5.06	4.20	1.64	1.70	3.34
Sixth spray	21	36	3.65	293.65	8.16	7.38	6.39	2.43	2.11	4.54
Commercial solution:										
Dormant spray	149	34	4.28	258.80	7.61	6.21	5.46	2.06	4.41	6.47
Pink spray	43	35	4.03	273.48	7.81	6.60	5.73	2.18	2.38	4.56
Calyx spray	154	35	4.13	268.51	7.67	6.35	5.62	2.11	2.31	4.42
Fourth spray	42	35	3.88	266.65	7.62	6.69	6.07	2.25	2.11	4.36
Fifth spray	61	34	4.66	216.39	6.36	5.27	4.71	1.76	1.92	3.68
Sixth spray	49	35	3.89	303.25	8.66	6.71	6.08	2.25	2.56	4.81

COMMERCIAL AND HOMEMADE LIME-SULPHUR COMPARISONS.

One hundred and fifty-four orchardists, or 71 per cent of those visited, used commercial lime-sulphur, and 28 per cent used homemade lime-sulphur. (See Table XVI.) It was found that the material cost per acre was less where the homemade solution was applied, although usually more material was applied per acre. The labor cost was about the same in both cases.

It was impossible in this investigation to make a comparative study of the results from the use of the homemade and the commercial lime-sulphur. However, with equal care in preparation and application, it would seem probable that there would be little difference between homemade and commercial solutions in fungicidal value.

COMPARATIVE EFFICIENCY OF DIFFERENT-SIZED SPRAYING CREWS.

TABLE XVII.—*Comparative labor and material cost per acre for spraying with different crews (35 trees per acre).*

	Per cent of growers using spray.	Acres in 10 hours.	Gallons.		Labor.		Cost per acre.		
			Per acre.	Per tree.	Man hours.	Horse hours.	Labor.	Material.	Total.
2–2 crew:									
Dormant spray	89	3.94	283.89	8.11	6.09	6.09	$2.13	$4.36	$6.49
Pink spray	24	3.96	327.26	9.63	6.02	6.02	2.11	2.85	4.96
Calyx spray	95	3.89	292.96	8.37	6.18	6.18	2.16	2.43	4.59
Fourth spray	27	3.88	275.86	7.88	6.07	6.07	2.12	2.10	4.22
Fifth spray	34	4.48	248.81	7.32	4.88	4.88	1.71	2.11	3.82
Sixth spray	35	3.70	309.38	8.84	6.51	6.51	2.28	2.58	4.86
3–2 crew:									
Dormant spray	94	4.73	240.78	6.88	7.06	4.71	2.12	3.48	5.60
Pink spray	34	4.52	248.88	7.32	7.78	5.19	2.33	1.87	4.20
Calyx spray	95	4.50	252.38	7.21	7.66	5.11	2.30	2.01	4.31
Fourth spray	27	4.35	268.72	7.46	8.22	5.48	2.47	1.91	4.38
Fifth spray	37	5.39	185.36	5.62	5.98	3.99	1.79	1.48	3.27
Sixth spray	26	4.16	299.80	8.33	8.40	5.60	2.52	2.35	4.87

Prior to 1916, 50 per cent of the apple growers visited used a crew of two men and two horses for spraying, while 40 per cent used a crew of three men and two horses. (See Table XVII.) It was found that in each county the 3-man, 2-horse crew sprayed more acres per day than the 2-man, 2-horse crew. More material was applied per acre and per tree with the crew of two men and two horses than with the larger crew, and the labor costs were about the same. Thus ordinarily the 3-man, 2-horse crew is to a considerable extent the more economical.

TABLE XVIII.—*Summary of annual spraying expenditures per acre (1910–1915).*

	Wayne.	Ontario.	Monroe.	Orleans.	Niagara.	All counties.
Labor:						
Man hours	18.28	18.71	20.39	23.02	21.98	20.50
Horse hours	14.97	15.32	18.92	20.62	19.77	17.96
Material:						
Gallons per acre	610.14	876.67	839.62	1,005.01	997.17	863.67
Gallons per tree	17.43	26.81	23.32	29.56	26.95	24.68
Cost per acre:						
Labor	$5.90	$6.04	$6.92	$7.70	$7.36	$6.79
Material	5.94	8.28	8.51	10.70	9.83	8.66
Total	11.84	14.32	15.43	18.40	17.19	15.45
Cost per tree:						
Labor	.1686	.1888	.1922	.2265	.1989	.1940
Material	.1697	.2588	.2364	.3147	.2657	.2474
Total	.3383	.4476	.4286	.5412	.4646	.4414

Table XVIII gives an annual summary of the spraying expenditures per acre.

APPLYING MATERIAL WITH A "SPRAY GUN."

The "spray gun" for applying liquid material was introduced in 1916 and is now in general use among the fruit growers of western New York. The shortage of labor and introduction of dust as a fungicide and insecticide had much to do in bringing about its use.

The gun was introduced after the completion of the principal part of this study, but it has had such a marked effect on labor requirements that it has seemed advisable to show the amount of spray material applied, the time required, and the total cost of spraying with this new method. In this area practically all spray crews now consist of two men and a team. One man does the driving, the other applies the material with the gun.

Material and labor costs have advanced since 1915. Commercial lime-sulphur, which formerly cost the farmer 14 cents, now is 18 cents per gallon, while lead-arsenate paste has advanced from 8 cents to 15 cents per pound. Man and horse labor which formerly figured at 20 and 15 cents per hour, respectively, are now 30 and 20 cents per hour.

By considering Tables XVII and XIX it will be noted that, owing to the use of the gun, approximately 40 per cent less of the diluted material is now being applied per acre than formerly, thereby decreasing the hours of labor. However, owing to increased labor and material costs per unit, the total cost of spraying remains approximately the same.

There is some question in the minds of many growers whether the new method is as efficient as the old. More or less injury to foliage and fruit has resulted, and many claim the codling-moth larvæ are not as well controlled as by the old method. From observation, however, it would seem that the greatest factor in obtaining good results is the man behind the gun. Some growers think they will return to the use of the pole and nozzles for the calyx spray, and sprays that are made on the foliage later in the season.

Definite conclusion as to the superiority of this new method over the one formerly used can not be drawn until the gun has been in use for a longer period.

TABLE XIX.—*Labor and material cost per acre (35 trees) for spraying with a crew of two men and two horses, with the use of a spray gun (1919).*

	Per cent of growers making spray.	Acres in 10 hours.	Gallons.		Hours per acre.		Cost per acre.		
			Per acre.	Per tree.	Man.	Horse.	Labor.	Material.	Total.
Delayed dormant spray	71	5.7	176	5	3.8	3.8	$1.90	$4.80	$6.70
Pink spray	69	5.5	189	6	3.9	3.9	1.95	2.80	4.75
Calyx spray	100	5.3	192	6	4.0	4.0	2.00	2.81	4.81
Two-week spray	72	5.8	185	6	3.6	3.6	1.80	2.63	4.43
Aug. 1 spray	33	5.2	171	5	3.9	3.9	1.95	2.72	4.67

TOTAL MAINTENANCE COST.

The total maintenance cost for the 218 farms was $24.75 per acre, or 29 cents per barrel. Deducting a credit for the use of the orchard as pasture, there is left a net cost of $24.04 per acre. This is about 20 per cent of the total net cost of production.

HANDLING THE CROP.

Handling the apple crop consists of picking, packing (whether in orchard or packing shed), hauling empty barrels to orchard and packed barrels to shipping point or storage, and all necessary labor in handling the cull apples.

There is considerable variation in the time required for handling the crop, according to method of management, distance the crop is hauled, and yield.

The handling of the average crop in the orchards required about 100 man hours and 30 horse hours per acre. This constitutes approximately 56 per cent of the total man hours and 32 per cent of the total horse hours required per year in the production of an acre of apples in western New York.

PICKING.

Picking apples by hand was practiced by 209 of the growers considered in this investigation, or 96 per cent. Nine orchardists in Wayne County shook their apples from the tree. Picking of the fall varieties usually begins with the Oldenburg about the middle or latter part of August, while the work on winter varieties usually begins with Rhode Island Greening about September 15. This is followed by the Tompkins King, which is generally picked about October 1; then come in order the Roxbury, Baldwin, Ben Davis, and Northern Spy.

One picking is usually made for each of the varieties grown in this area, except the Oldenburg, of which it is not uncommon to make from two to four pickings, sorting for size and color. Occasionally fruit of the other varieties does not ripen regularly and it is necessary to pick for size and color.

As the Baldwin and Rhode Island Greening are the principal varieties grown, this discussion will be confined chiefly to them. Since a large percentage of these varieties is stored in common storage or cold storage, they are usually picked before they are mature. Picking the Rhode Island Greening is usually begun when the seeds of the apple are beginning to turn brown, regardless of the size or color of the fruit. Ordinarily particular care is taken as to the time of picking and condition of this variety because of its tendency to scald in storage if not properly handled.

Men, women, and boys are employed at harvest. Men generally do most of the picking. The half-bushel basket, 3-peck basket, or

canvas picking bag is used. Picking ladders vary from 20 to 30 feet in length.

Day labor is figured at $2 per day, or 20 cents per hour. Contract pickers, or those working at a stipulated rate per barrel, receive from 10 to 15 cents per barrel, depending upon the season and type of worker. The usual price is 12½ cents per barrel with board and 15 cents per barrel without board.

When the crop is large, probably more apples are picked by the barrel than by the day. In small-crop years the fruit is sparsely distributed and the pickers do not care to work by the barrel, since often it is hard to make a fair wage.

Picking by the barrel also necessitates an extra handling of the fruit, which many growers consider undesirable. However, many men who have had the same pickers season after season find it is an advantage to have their fruit picked by the barrel, for when the crop is large considerable money may often be saved by getting the fruit picked when in the proper condition and taken directly to storage.

Prior to 1917 many of the growers in western New York depended upon transient labor for pickers. Where orchards were not far from the larger cities help could be easily obtained.

Of the growers here considered, 123, or 56 per cent, had their apples picked by the day, while 86, or 40 per cent, had their apples picked by the barrel. In getting estimates the grower was asked to give the average number of barrels per day that the day or contract picker would pick with a light crop and with a heavy crop, and an average of these two estimates was taken for each record. The day laborer picked on an average 20 loose barrels in 10 hours, while the contract laborer picked on an average 25 loose barrels in 10 hours.

TABLE XX.—*Number of barrels picked in 10 hours and cost per acre and per graded barrel.*

Counties.	Day pickers.					Contract pickers.					All picking.				
	Records.	Ungraded barrels in 10 hours.	Man hours.	Cost.		Records.	Ungraded barrels in 10 hours.	Man hours.	Cost.		Records.	Ungraded barrels in 10 hours.	Man hours.	Cost.	
				Per acre.	Per barrel.				Per acre.	Per barrel.				Per acre.	Per barrel.
Wayne	19	20	50.49	$10.10	$0.1472	16	26	40.42	$15.11	$0.1910	35	23	45.89	$12.39	$0.1688
Ontario	36	20	58.20	11.64	.1207	6	21	42.67	13.11	.1760	42	20	55.98	11.85	.1270
Monroe	18	18	55.98	11.20	.1449	29	25	42.96	15 46	.1712	47	22	48.17	13.82	.1620
Orleans	24	24	45.11	9.02	.1059	26	26	41.69	15.61	.1768	50	25	43.33	12.45	.1434
Niagara	26	19	58.12	11.62	.1388	9	25	36.67	13.41	.1795	35	20	52.61	12.08	.1484
All counties	123	20	54.11	10.82	.1282	86	25	41.39	15.06	.1774	[a] 209	22	48.95	12.57	.1486

[a] Nine men in Wayne County shake their apples from the tree.

There is considerable variation in the number of barrels picked per day by both day and contract workers. (See Table XX.) Men paid by the barrel pick between 30 and 40 barrels per day during heavy crop years. With exceptionally large crops, some men will pick as high as 50 to 60 barrels per day. The rate of picking will vary to a great extent with size of crop and of trees, distance trees are planted apart, mode of tree growth, and kind of ladders and picking utensils which the picker is required to use.

When apples are picked by the day, the picker carries his apples to the sorting table, which is usually placed in a central position, so that all pickers carry their fruit about the same distance. Often when contract picking is done the barrels are placed near the trees from which the fruit is picked. Apples are placed in these barrels by the picker, who marks his barrels as they are filled or has his tally card punched by the foreman.

The average cost for picking by the day was $10.82 per acre (yield 84.4 barrels per acre) or 13 cents per barrel, while a contract picker picked at a cost of $15.06 per acre (yield 84.9 barrels per acre) or 18 cents per barrel. The average cost, considering both methods of picking, was $12.57 per acre, or 15 cents per barrel. All labor in harvesting, except contract labor, is figured at 20 cents per hour. The picking cost was about 33 per cent of the total net labor cost, or 10 per cent of the total net cost of production.

It will be seen (Table XIX) that in Ontario and Niagara Counties the majority of growers visited picked their apples with day labor. In Wayne County there is a tendency toward day pickers, while in Monroe and Orleans Counties the growers depend to a great extent on contract pickers.

SORTING AND PACKING.

Sorting and packing are done in the orchard, barn, or packing shed (see figs. 6 and 7). Practically all apples are sorted and packed from a sorting table. The common sorting table is usually 8 feet in length and 3 feet in width, inside measurement. Some growers use a level table, from which all apples are hand sorted into baskets and then packed in barrels.

As soon as the apples are picked in one section of the orchard the sorting table is moved to another. Many of the orchardists who pack in the orchard make a practice of hauling a few apples into a shed or barn, so that in case of unfavorable weather the packing will not be delayed.

Prior to the passage of the New York State packing law apples were packed either "orchard run," "number ones," or "number twos." "Orchard-run" apples took in all sizes of apples above a minimum which might be stated by the buyer. "No. 1" apples

were $2\frac{1}{2}$ inches and over in diameter and practically free from scale, bruises, or blemishes. "No. 2" were apples which were below this

FIG. 6.—Picking, sorting, and packing apples in a western New York orchard.

size and of a fair quality. In those days the pack depended mostly upon the farmer himself, or, if the apples had been sold to a buyer,

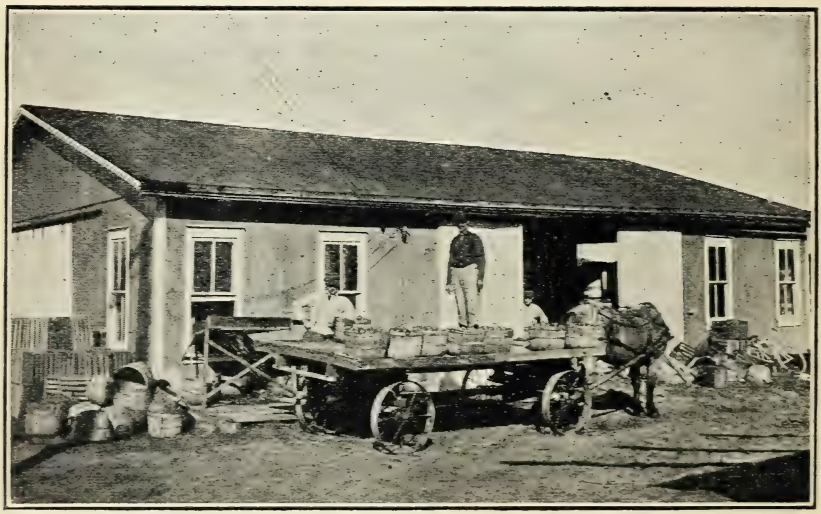

FIG. 7.—Delivering apples in bushel baskets to packing shed, where they are sized on a mechanical sizer.

upon his specific directions as to the pack he desired. Often the buyer furnished a packer to insure proper grading. Many times

apples were run into the barrel just as they came from the orchard, covered with burlap, and taken directly to the storage, there to be repacked when ready for market, according to the size and quality which the buyer might designate.

Under the State law now in force the standard grades or classes for apples grown in this State when packed in closed packages are as follows: (1) New York Standard Fancy Pack; (2) New York Standard A Grade; (3) New York Standard B Grade; (4) New York Standard C Grade; (5) Unclassified. The minimum size of fruit in all these classes, including the unclassified, is determined

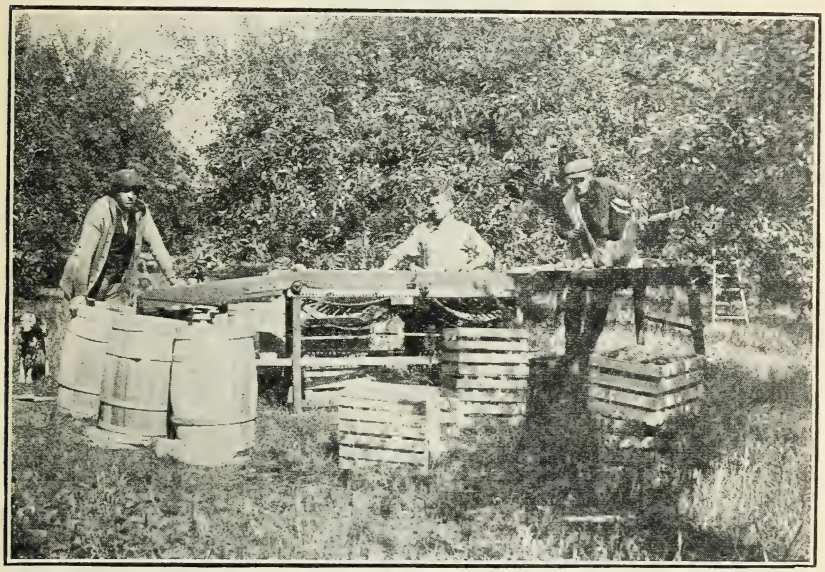

FIG. 8.—A type of sizer used by many apple orchardists in western New York.

by taking the transverse diameter of the smallest fruit in the package at right angles to the stem axis. The minimum sizes are to be stated in variations of one-fourth inch, 2 inches, $2\frac{1}{4}$ inches, $2\frac{1}{2}$ inches, $2\frac{3}{4}$ inches, 3 inches, $3\frac{1}{4}$ inches, and so on, in accordance with the facts.

It is believed by many that the quantity of marketable fruit produced in New York will not be curtailed by this law and that its enforcement will prove of great benefit to the apple growers of the State.

At the time of this investigation the majority of growers visited sorted and packed by hand in the orchard, though there was a growing tendency toward packing in the packing shed or barn. Many of the growers were considering buying sizers (see fig. 8). The average grower has so small an acreage of summer or fall fruit that the majority of it is still hand sorted and packed. The sizer is

used to a great extent on the winter varieties, principally the Rhode Island Greening and Baldwin. No doubt within a few years the majority of commercial apple growers in these counties will be using mechanical sizers and packing a considerable amount of their fruit in the packing shed or barn or in community packing houses.

By referring to Table XXI, it will be seen that the growers of Orleans County sorted and packed their fruit most cheaply, while the average cost for these operations was greatest in Ontario County. Considering 188 growers who sorted and packed their own fruit, regardless of whether or not they used sizers, it required on an average 36.72 man hours for sorting and packing an acre of fruit. The total cost per acre for sorting and packing was $7.35, or 9 cents per barrel.

TABLE XXI.—*Average time and cost per acre for sorting and packing (western New York, 1910–1915).*

Counties.	Sorting and packing.				
	Number of records.	Barrels in 10 hours.	Man hours.	Cost.	
				Per acre.	Per barrel.
Wayne	32	29	31.10	$6.22	$0.0856
Ontario	34	25	46.18	9.24	.0981
Monroe	38	25	39.18	7.84	.0930
Orleans	49	28	33.30	6.70	.0771
Niagara	35	26	34.94	6.99	.0859
All counties	188	27	36.72	7.35	.0872

CULL APPLES.

The solution of the problem of the disposition of cull apples has led to the development of one of the greatest of American by-product industries. Each year large quantities of these low-grade apples are used both for drying and for making cider. It often happens that western New York growers experience severe local hail or wind storms, injuring many apples and sometimes making windfalls of thousands of bushels of what would have been first-class marketable stock. In such cases dry houses and cider mills sometimes open for business very early, so that the farmer may haul in fruit which otherwise might be wasted. If the wind is severe enough to take off any great quantity of apples during harvest, all hands employed are usually turned to picking up the fruit.

Scattered throughout the apple-producing counties of the State may be found several by-product plants (see fig. 9). A few years ago it was not uncommon for some of the growers to have drier kilns on their own farms. Apples in many instances were not picked, but

shaken from the trees and used almost exclusively for drier stock. However, since the price of barreled fruit has advanced, the practice

FIG. 9.—A small apple drier, Wayne County, N. Y.

of shaking apples from the trees has become a thing of the past. Growers seem to find it more to their liking to sell this stock rather

FIG. 10.—Delivering cider apples in bulk to the cider mill.

than dry it themselves. One often finds a farmer, however, who still dries his own stock and what other dryable fruit he is able to buy in

the immediate vicinity. The quantity of apples used for drying or cider varies from year to year. About one-third of the apples used

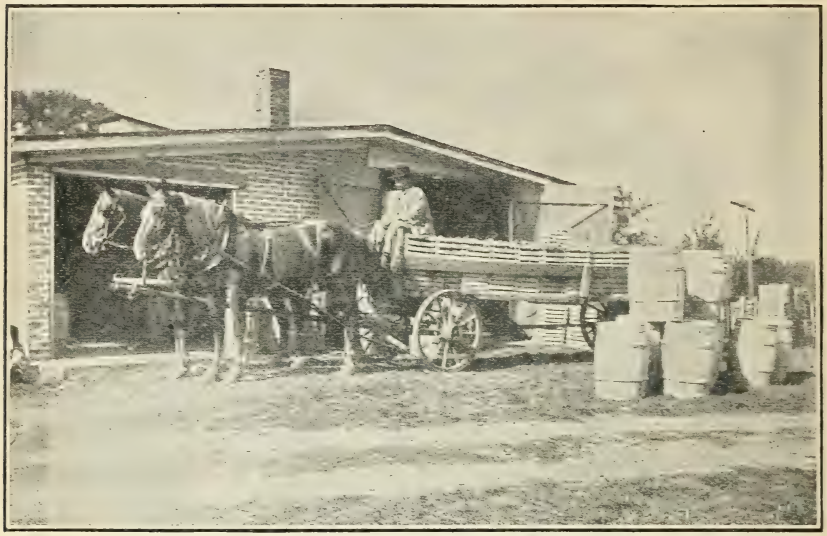

FIG. 11.—Hauling a load of about 50 bushels of cider apples in crates.

for these purposes are picked from the ground, the remainder being sorted out at packing time.

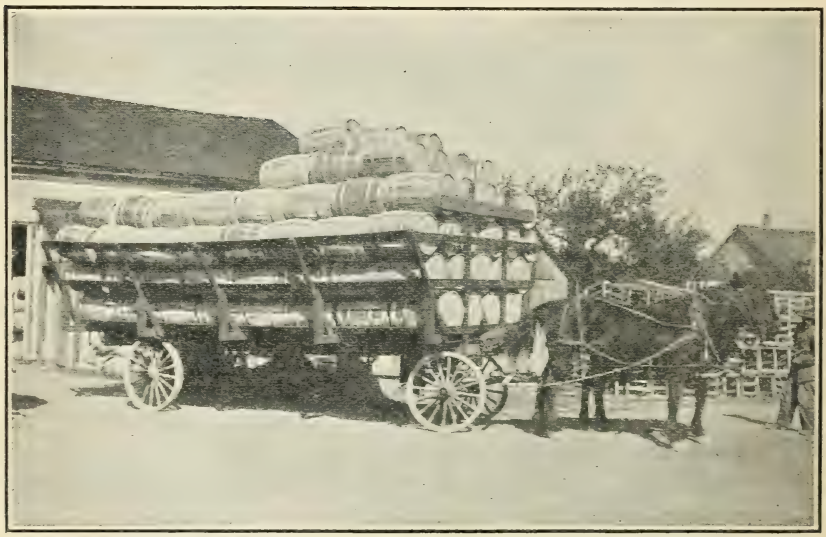

FIG. 12.—Hauling barrels, 180 to the load, from the cooper shop to the orchard.

Drier or cider apples are hauled in bulk, crates, sacks, or barrels (see figs. 10 and 11). The usual practice is to haul them in crates, delivering the apples to the factory and returning with the empty

crates. Very few of the cull apples produced in the lake counties are shipped outside of the immediate district. However, in Ontario County it is the practice of some farmers to sell this grade of fruit to a dry house at some considerable distance. This necessitates loading the apples into cars.

The price paid for cull apples varies with the season and the condition of the fruit. The market prices of the by-products control, to a great extent, the price paid for culls. Late in the season, just prior to the time of picking, or during picking, this type of dropped apple may bring anywhere from 75 cents to $1.25 a hundredweight. When the crop is large and the price of barreled apples low, cull apples usually bring 25 to 35 cents a hundredweight. Within the last few years this grade of apple has usually brought from 50 to 75 cents per hundredweight delivered at the cider mill or drier.

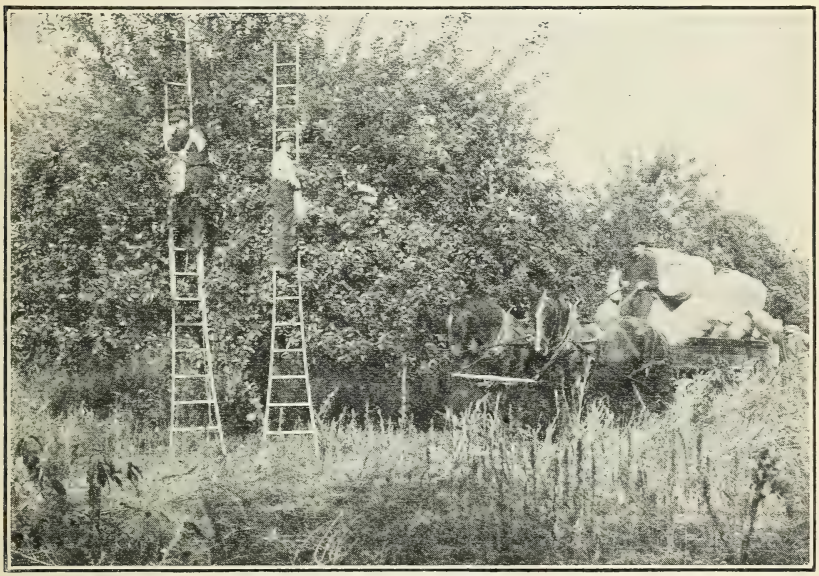

FIG. 13.—Hauling empty barrels to the orchard.

Of course cider stock will not bring the price that is paid for drier stock. No separation was made of the prices received for cider and drier stock, so that the figures here presented represent average prices of drier and cider stock together. About 25 per cent of the total yield of the orchards visited was sold as drier or cider apples.

HAULING THE BARRELED FRUIT.

Apple barrels are usually delivered to the farm by the cooper or dealer, no separate charge being made for hauling (see fig. 12). The cost of hauling barrels therefore does not appear as a separate item

among those which enter into the cost of production, but is included under the cost of barrels. The barrels necessary for the crop are not usually all delivered at once, for the farmers do not ordinarily have enough storage room for them. Uusally enough are delivered and stored so that the grower will have sufficient to carry him through the first few days of apple harvest. The rest of the barrels are delivered later, and are usually unloaded in the orchard.

Since some of the barrels are thus stored on the farm, it necessitates hauling them to the orchard at harvest time. This hauling is done by the farmer and is charged under "other hauling." However, farmers often haul out each morning just enough barrels to

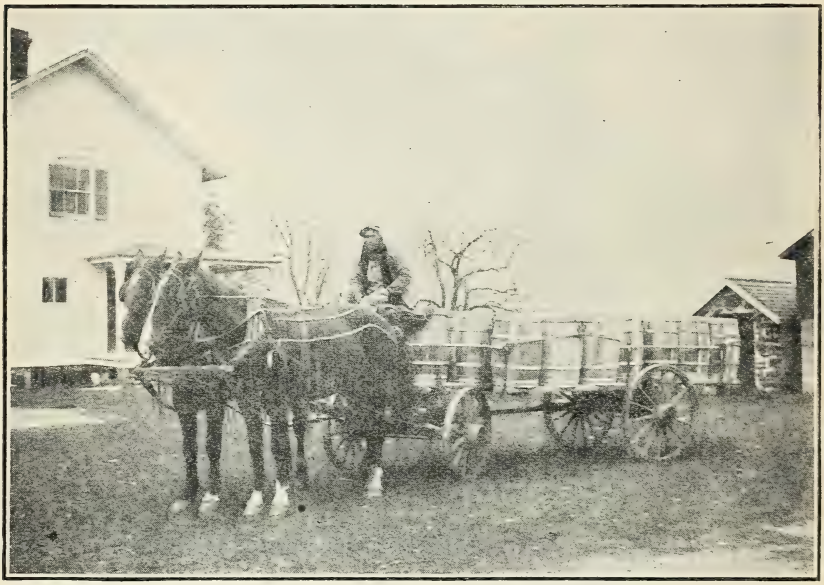

FIG. 14.—Hauling a load of about 26 barrels to market, at a cost of about 2 cents per barrel per mile.

last until one or more loads of packed apples are hauled to the storage or shipping point, depending on the teamster returning from storage or station to drive by the barn or shed and get more barrels. (See fig. 13.)

Where apples are packed in a packing shed, some of the growers keep one man busy hauling the apples to the shed as picked. Either baskets, crates, or barrels are used for this purpose. This cost is also considered under "other hauling."

There are different methods of hauling packed apples to the storage or market; generally the regular farm wagons are used. A crew of one man and team will haul from 20 to 35 barrels per load, depending upon the outfit. (See fig. 14.) A few growers haul the

apples by auto truck. One hundred and ninety-three orchardists used teams for hauling an average of 23 packed barrels a distance of 2.26 miles at a cost of $4.39 per acre, or about 5 cents per barrel. The average cost per barrel per mile was a little over 2 cents. (See Table XXII.)

Figure 15 shows a typical western New York apple cold-storage plant.

FIG. 15.—A typical western New York apple storage.

TABLE XXII.—*Average time and cost for hauling to the station when a crew of 1 man and 2 horses is used (western New York).*

County.	Number of records.	Yield per acre.	Load (barrels).	Per acre.			Cost per barrel.	Miles hauled.	Cost per barrel per mile.
				Man hours.	Horse hours.	Cost.			
Wayne	33	72.5	24	8.58	17.16	$4.29	$0.0592	2.68	$0.0221
Ontario	35	90.5	22	8.96	17.92	4.48	.0495	1.82	.0272
Monroe	46	85.9	22	8.07	16.14	4.04	.0470	2.04	.0230
Orleans	46	85.8	24	8.80	17.60	4.40	.0513	2.51	.0204
Niagara	33	82.1	20	9.70	19.40	4.85	.0591	2.26	.0262
All counties	193	83.8	23	8.77	17.54	4.39	.0524	2.26	.0232

SUMMARY OF COSTS.

TOTAL HANDLING COSTS.

The total harvest labor cost for the 218 farms studied in western New York is $26.52 per acre, or 32 cents per barrel. Deducting the value of culls, there is a net cost of $12.06 per acre for harvesting. This is about 10 per cent of the total net cost of production. (See Table XXIII.)

TABLE XXIII.—*Summary of all labor costs (218 records, Western New York 1910–1915, inclusive).*[1]

Item.	Wayne (44 records; 73.2 barrels).		Ontario (42 records; 93.3 barrels).		Monroe (47 records; 85.3 barrels).		Orleans (50 records; 86.8 barrels)	
	Cost.		Cost.		Cost.		Cost.	
	Per acre.	Per barrel.	Per acre.	Per barrel.	Per acre.	Per barrel.	Per acre.	Per barrel
Manuring	$2.11	$0.0288	$2.22	0.0238	$1.76	$0.0206	$2.36	$0.0272
Fertilizing	.40	.0055	.08	.0009	.18	.0021	.07	.0008
Pruning	5.40	.0738	5.92	.0634	4.15	.0486	4.00	.0461
Brush	2.34	.0320	2.46	.0264	1.96	.0230	1.74	.0200
Plowing	2.25	.0307	2.94	.0315	2.41	.0283	1.97	.0227
Other cultivating	4.44	.0607	4.75	.0509	4.58	.0537	3.20	.0369
Thinning	.99	.0135	1.44	.0154	.58	.0068	.51	.0059
Propping	.74	0101	.82	.0088	.34	.0040	.86	.0099
Miscellaneous	.06	.0008	.22	.0024	.05	.0006	.05	.0006
Sowing cover crop	.11	.0015	.11	.0012	.09	.0011	.08	.0009
Harrowing cover crop	.30	.0041	.33	.0035	.25	.0029	.22	.0025
Mowing	.08	.0011	.05	.0005	.16	.0019	.13	.0015
Dormant spray	1.70	.0232	1.84	.0197	1.96	.0230	2.21	.0255
Summer spray	4.20	.0574	4.21	.0451	4.96	.0581	5.49	.0632
Total maintenance labor cost	25.12	.3432	27.39	.2935	23.43	.2747	22.89	.2637
Pasture credit	.90	.0123	1.25	.0134	.76	.0089	.53	.0061
Total net maintenance labor cost	24.22	.3309	26.14	.2801	22.67	.2658	22.36	.2576
Haul to station	3.66	.0500	5.18	.0555	4.00	.0469	4.63	.0533
Other hauling	1.14	.0156	.72	.0077	.57	.0067	.86	.0099
Picking	9.86	.1347	11.85	.1270	13.82	.1620	12.45	.1434
Shake, pick up, and haul	4.53	.0619						
Sort and pack	4.52	.0617	7.44	.0798	6.34	.0743	6.56	.0756
Pick up and haul culls	2.12	.0289	1.86	.0199	1.73	.0203	2.11	.0243
Total handling labor cost	25.83	.3528	27.05	.2899	26.46	.3102	26.61	.3065
Cull credit	22.68	.3098	13.57	.1454	11.30	.1325	13.44	.1548
Total net handling labor cost	3.15	.0430	13.48	.1445	15.16	.1777	13.17	.1517
Total net labor cost	27.37	.3739	39.62	.4246	37.83	.4435	35.53	.4093

Item.	Niagara (35 records; 81.4 barrels).		Five counties (218 records; 84.1 barrels).			
	Cost.		Cost.		Per cent of total net labor cost.	Per cent of total net cost.
	Per acre.	Per barrel.	Per acre.	Per barrel.		
Manuring	$1.71	$0.0210	$2.05	$0.0244	5.68	1.73
Fertilizing	.07	.0009	.16	.0019	.44	.13
Pruning	5.01	.0615	4.85	.0577	13.43	4.08
Brush	2.33	.0286	2.14	.0254	5.93	1.80
Plowing	2.54	.0312	2.40	.0285	6.65	2.02
Other cultivating	4.54	.0558	4.26	.0506	11.80	3.59
Thinning	1.08	.0133	.89	.0106	2.47	.75
Propping	.58	.0071	.67	.0080	1.86	.56
Miscellaneous	.03	.0004	.08	.0009	.22	.07
Sowing cover crop	.05	.0006	.09	.0011	.25	.08
Harrowing cover crop	.18	.0022	.26	.0031	.72	.22
Mowing	.05	.0006	.10	.0012	.28	.08
Dormant spray	2.25	.0276	1.99	.0237	5.51	1.68
Summer spray	5.11	.0628	4.81	.0572	13.32	4.05
Total maintenance labor cost	25.53	.3136	24.75	.2943	68.56	20.84
Pasture credit	.04	.0004	.71	.0084	1.97	.60
Total net maintenance labor cost	25.49	.3132	24.04	.2859	66.59	20.24
Haul to station	4.69	.0576	4.41	.0524	12.22	3.71
Other hauling	1.05	.0129	.86	.0102	2.38	.72

[1] All man labor is figured at 20 cents per hour, except some packing which is contracted at 15 cents per barrel. Horse labor is figured at 15 cents per hour.

TABLE XXIII.—*Summary of all labor costs (218 records, Western New York, 1910–1915, inclusive)*—Continued.

Item.	Niagara (35 records; 81.4 barrels).		Five counties (218 records; 84.1 barrels).			
	Cost.		Cost.		Per cent of total net labor cost.	Per cent of total net cost.
	Per acre.	Per barrel.	Per acre.	Per barrel.		
Picking	$12.08	$0.1484	$12.05	$0.1433	$33.38	$10.15
Shake, pick up, and haul			.92	.0109	2.55	.77
Sort and pack	6.99	.0859	6.34	.0754	17.56	5.34
Pick up and haul culls	1.82	.0223	1.94	.0231	5.37	1.63
Total handling labor cost	26.63	.3271	26.52	.3153	73.46	22.32
Cull credit	10.91	.1340	14.46	.1719	40.05	12.17
Total net handling labor cost	15.72	.1931	12.06	.1434	33.41	10.15
Total net labor cost	41.21	.5063	36.10	.4293	100.00	30.39

TOTAL LABOR COST.

The total labor cost for the 218 farms amounted to $51.27 per acre, or 61 cents per barrel. After credit is allowed for pasture and cull apples there is a net labor cost of $36.10 per acre, or 43 cents per barrel, which is about 30 per cent of the total net cost of production. The net maintenance cost per barrel is 29 cents, or 67 per cent of the total net labor, while the net handling cost per barrel is 14 cents, or 33 per cent of the total labor cost.

COSTS OTHER THAN LABOR.

Costs other than labor comprise material and fixed costs. The former includes the charge for barrels, spray materials, manure, fertilizer, cover crop, seed, gasoline, oil, etc. The latter includes owned equipment and building charges, spray rig hire, taxes, insurance, and interest on investment.

The average price per ton of manure is $1.75. The average amount applied annually per acre is 4.83 tons, making the yearly cost $8.45 per acre, or 10 cents per barrel.

Spraying materials are charged at regular prices paid, or the farmer's estimated value of the same. Commercial lime-sulphur price was given at 14 cents per gallon, while the estimated value of the homemade material was 7 cents per gallon. The majority of growers used lead arsenate paste as a poison. A few used dry lead arsenate. The prices of the former vary to some extent, but in arriving at the cost given herein an average of 8 cents per pound was used. A tobacco extract was often used at a cost of $12.50 per gallon.

The kinds and amounts of commercial fertilizer used in the orchards of western New York varied to a considerable degree. The cost per ton varied from $12 to $52.

Seed for cover crops, such as mammoth clover, cow-horn turnips, rape, barley, vetch, buckwheat, etc., is charged at the market price for the same at the time of this investigation. Gasoline was figured at the rate of 25 cents per gallon, with a nominal charge for oil, etc. The price of barrels varied from 35 to 38 cents, 36 cents being the charge used. The total material cost amounted to $49.07 per acre, or 58 cents per barrel. This is 41 per cent of the total annual net cost of production.

The fixed costs amount to $33.61 per acre, or 40 cents per barrel, which is 28 per cent of the annual net cost of production. In these charges are certain items which are not usually considered by the grower in arriving at the cost. These items will be noted in Table XXIV. Few of the farmers of western New York have buildings which are used exclusively as packing sheds during the apple harvest. The greater part of the fruit is packed in the orchard. However, there is a tendency toward packing more fruit under cover. A few of the growers pack in their barns. This is especially the case during a rainy harvesting season. For this reason it is necessary, in determining the cost of production, to include a nominal charge for the use of buildings. This amounts to $1.99 per acre annually, or a little over 2 cents per barrel. The equipment charge for the farms considered amounts to $3.10 per acre, or nearly 4 cents per barrel. This includes depreciation, upkeep, and interest on the investment. But few of the growers in western New York hire spray rigs. This charge is prorated over all records so as to arrive at proper regional cost of production. Taxes amounted to $2.30 per acre, or about 3 cents per barrel. The orchard's share of the insurance is 43 cents per acre, or $0.005 per barrel. The interest on investment in the apple orchard is the second largest single item entering into the cost of production, making up about 22 per cent of the total net cost of production on the farms studied. This charge is figured on an average investment of $514.35 per acre. The interest charge per acre is $25.72, or 31 cents per barrel. The total material and fixed costs for all records is made up of about 60 per cent of material and 40 per cent fixed charges, or $82.68 per acre and 98 cents per barrel, or about 70 per cent of the total annual net cost of production.

TABLE XXIV.—*Summary of all material and fixed costs (218 records, western New York, 1910–1915, inclusive).*

Item.	Wayne (44 records; 73.2 barrels).		Ontario (42 records; 93.3 barrels).		Monroe (47 records; 85.3 barrels).		Orleans (50 records; 86.8 barrels).	
	Cost.		Cost.		Cost.		Cost.	
	Per acre.	Per barrel.	Per acre.	Per barrel.	Per acre.	Per barrel.	Per acre.	Per barrel.
Manure	$7.78	$0.1063	$9.52	$0.1020	$8.28	$0.0971	$9.17	$0.1057
Fertilizer	4.14	.0565	.70	.0075	1.61	.0189	.68	.0078
Dormant spray material	2.67	.0365	3.65	.0391	3.28	.0385	4.58	.0528
Summer spray material	3.27	.0447	4.63	.0496	5.23	.0613	6.12	.0705
Seed	1.63	.0223	1.05	.0113	1.04	.0122	1.14	.0131
Gasoline and oil	.35	.0048	.50	.0054	.60	.0070	.71	.0082
Barrels	19.71	.2692	32.21	.3452	30.72	.3601	31.24	.3599
Total material cost	39.55	.5403	52.26	.5601	50.76	.5951	53.64	.6180
Interest	24.98	.3413	18.66	.2000	28.06	.3289	31.48	.3627
Apple-building charge	5.66	.0773	1.90	.0204	1.44	.0169	.44	.0050
Equipment charge	2.65	.0362	3.56	.0382	2.88	.0338	3.08	.0355
Spray rig hire	.13	.0018	.25	.0027				
Taxes	1.93	.0264	2.00	.0214	2.37	.0278	3.01	.0347
Insurance	.39	.0053	.27	.0029	.56	.0065	.48	.0055
Total fixed cost	35.74	.4883	26.64	.2856	35.31	.4139	38.49	.4434
Total material and fixed cost	75.29	1.0286	78.90	.8457	86.07	1.0090	92.13	1.0614

Item.	Niagara (35 records; 81.4 barrels).		Five counties (218 records; 84.1 barrels).			
	Cost.		Cost.		Per cent of total material and fixed cost.	Per cent of total net cost.
	Per acre.	Per barrel.	Per acre.	Per barrel.		
Manure	$7.21	$0.0885	$8.45	$0.1005	10.22	7.11
Fertilizer	.84	.0103	1.61	.0192	1.95	1.36
Dormant spray material	4.45	.0547	3.71	.0441	4.49	3.12
Summer spray material	5.38	.0661	4.94	.0587	5.97	4.16
Seed	.65	.0080	1.12	.0133	1.35	.94
Gasoline and oil	.64	.0079	.56	.0067	.68	.47
Barrels	29.29	.3598	28.68	.3410	34.69	24.15
Total material cost	48.46	.5953	49.07	.5835	59.35	41.31
Interest	23.75	.2918	25.72	.3058	31.11	21.65
Apple-building charge	.41	.0050	1.99	.0237	2.41	1.68
Equipment charge	3.42	.0420	3.10	.0369	3.75	2.61
Spray rig hire			.07	.0008	.08	.06
Taxes	2.01	.0247	2.30	.0273	2.78	1.94
Insurance	.43	.0053	.43	.0051	.52	.36
Total fixed cost	30.02	.3688	33.61	.3996	40.65	28.30
Total material and fixed cost	78.48	.9641	82.68	.9831	100.00	69.61

ALL COSTS.

Considering all costs, i. e., the total labor cost, the material and the fixed cost, the total net cost of production for the 218 farms was $118.78 per acre, or an average of $1.41 per barrel. (See table XXV.)

INFLUENCE OF YIELD PER ACRE ON COST PER BARREL.

Figure 16 shows the distribution of growers and the total number of barrels produced on the basis of the net cost per barrel. It will

be seen that 92 per cent produced apples at a cost of $1.95 per barrel and under, while the average selling price per barrel was $2.20. By eliminating the extremely high and low costs it is found that 85 per cent produced at from $1.05 to $1.95.

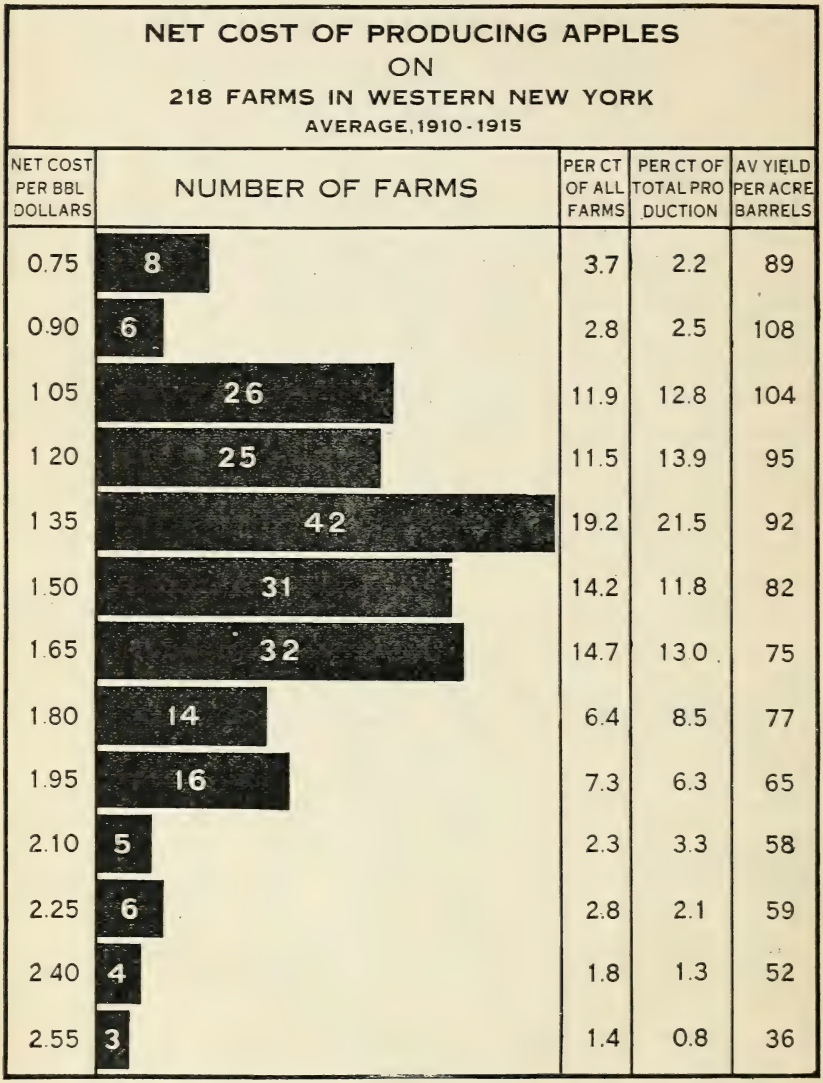

FIG. 16.—Frequency graph showing distribution of records on the basis of the net cost of production per barrel of apples. (Western New York.)

The yields for the 73 per cent range from 104 down to 65 barrels per acre, the average for the entire region being 84. Arranged on a basis of net cost per barrel, it may be shown that yields drop with fair regularity from 104 barrels in the $1.05 group to 65

barrels in the $1.95 group, bringing out the fact that there is a tendency toward a high cost of production as the yields decrease. However, this was not the case with every grower. To illustrate, one grower had a yield of 190 barrels per acre; the average for all records was 84 barrels. Yet the cost of production per barrel for this grower was $1.45, or 4 cents per barrel higher than the average. By analyzing this particular record it was found that his net handling cost was 32 cents per barrel, the average for the region being only 14 cents. This difference was due to several factors. He hauled his apples eight miles to market at a cost of 9 cents more per barrel than the average grower. He did not grade his fruit as thoroughly as the average. His cull-apple credit was lower by 9 cents per barrel than the average. The cost of sorting and packing was 3 cents more per barrel, since he only put up 16 barrels per day, while the average grower packed 27 barrels.

There is a variation in the general method of orchard management throughout western New York, and a wide range in the cost of production. A high yield per acre of apples does not necessarily mean a low cost of production per barrel. However, there is a tendency for this to be the case. Generally speaking, to decrease the unit cost the yield per acre must be increased.

TABLE XXV.—*Summary of all costs (218 records, western New York, 1910–1915, inclusive).*

Item.	Wayne (44 records; 73.2 barrels).		Ontario (42 records; 93.3 barrels).		Monroe (47 records; 85.3 barrels).		Orleans (50 records; 86.8 barrels).	
	Cost.		Cost.		Cost.		Cost.	
	Per acre.	Per barrel.	Per acre.	Per barrel.	Per acre.	Per barrel.	Per acre.	Per barrel.
Total net maintenance labor cost	$24.22	$0.3309	$26.14	$0.2801	$22.67	$0.2658	$22.36	$0.2576
Total net handling labor cost	3.15	.0430	13.48	.1445	15.16	.1777	13.17	.1517
Total net labor cost	27.37	.3739	39.62	.4246	37.83	.4435	35.53	.4093
Total material cost	39.55	.5403	52.25	.5601	50.76	.5951	53.64	.6180
Total fixed cost	35.74	.4883	26.64	.2856	35.31	.4139	38.49	.4434
Total material and fixed costs	75.29	1.0286	78.90	.8457	86.07	1.0090	92.13	1.0614
Total net cost	102.66	1.4025	118.52	1.2703	123.90	1.4525	127.66	1.4707

TABLE XXV.—*Summary of all costs (218 records, western New York, 1910–1915, inclusive)*—Continued.

Item.	Niagara (35 records; 81.4 barrels).		Five counties (218 records; 84.1 barrels).		Per cent of total net cost.
	Cost.		Cost.		
	Per acre.	Per barrel.	Per acre.	Per barrel.	
Total net maintenance labor cost	$25.49	$0.3132	$24.04	$0.2859	20.24
Total net handling labor cost	15.72	.1931	12.06	.1434	10.15
Total net labor cost	41.21	.5063	36.10	.4293	30.39
Total material cost	48.46	.5953	49.07	.5835	41.31
Total fixed cost	30.02	.3688	33.61	.3996	28.30
Total material and fixed costs	78.48	.9641	82.68	.9831	69.61
Total net cost	119.69	1.4704	118.78	1.4124	100.00

PRICES RECEIVED FOR FRUIT.

Within the last few years there has been an increased demand for apples. The population has also increased to a great extent, as has the number of apples eaten per individual. With an increased demand, which has exceeded, in some years, the supply, there has been a gradual increase in the price received by farmers for the product. Some years have been very discouraging, not only because of the low price received for the product, but because of the several natural difficulties with which the grower has had to contend. Some years it has been hail, in other seasons wind, and each year must be kept up the constant fight for the control of insect pests and fungus diseases. However, the apple grower of western New York is still producing apples commercially and much of his success is due to the type of farming which has been practiced for the last fifty years.

The majority of growers in the counties considered sell their product at the time of harvest. However, there is a growing tendency toward storing. The returns received f. o. b. by the growers from whom figures were obtained averaged $2.84 in 1910, $2.29 in 1911, $1.83 in 1912, $2.80 in 1913, $1.63 in 1914, and $2.47 in 1915. There was some variation in the prices received for the different varieties, due not merely to differences in quality, but to a considerable degree to the ability of some growers to obtain a better price than others. This is a personal factor, and perhaps one of the chief factors of success in the cases of many of the farmers of this area.

In determining the net profit received for a product, it is usual to find the total cost and subtract from that figure the receipts from the by-product, if any. The balance is the net cost. The product in this particular instance is the marketable barreled apple. The by-prod-

ucts are the apples sold to the dryer, cannery, or cider mill. The average price received for apples by the growers considered in this investigation was $2.20 per barrel. The average net cost of production was $1.41. By deducting the same it will be found that the average net profit was 79 cents per barrel, with an average yield of 84 barrels per acre, or a net profit of $66.36 per acre. If interest on investment ($25.72) is considered as profit rather than as expense, there is a net profit of $92.08 per acre, or 18 per cent on the investment of $514.

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